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Report No. CG-D-09-99, II

United States Coast Guard Integrated Risk Assessment Process

Volume II

(Coarse Hazard Analysis of a WMEC-210 Vessel in Support of the Paragon Project and Coarse Hazard Analysis of the Integrated Support Command (ISC) at Seattle, WA)

FINAL REPORT
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15. Supplementary Notes

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16. Abstract

Due to the new challenges (e.g., government downsizing, increased system complexity, ever-changing high-risk operations) faced by the Coast Guard, the Coast Guard Research and Development Center (RDC) was requested to explore the possibility of applying system safety concepts, including the use of risk analysis and enhancement of inspection procedures, to improve Coast Guard operations and facility safety. The Coast Guard RDC teamed with JBF Associates, Inc. (JBFA), a consulting firm specializing in hazard and risk analysis/ management, to develop a risk-based loss prevention program. The initial focus was on developing one portion of the risk-based loss prevention program, a risk assessment process. This report discusses the development, validation, and end product (the Integrated Risk Assessment [IRA] process) of this effort. Effective implementation of the IRA process provides the Coast Guard with risk-based information for: 1) controlling and reducing loss exposure, (2) making risk-based decisions, and (3) using limited resources more efficiently. The IRA process proved to be an effective and efficient risk assessment tool for various types of vessels and their operations, as well as shore facilities and their operations.

This report contains three volumes. Volume I consists of the main text of the report and Attachment A: Integrated Risk Assessment (IRA) Manual. Volume II consists of Attachment B: Coarse Hazard Analysis of a WMEC-210 Vessel in Support of the Paragon Project and Attachment C: Coarse Hazard Analysis of the Integrated Support Command (ISC) at Seattle, WA. Volume III consists of Attachment D: Detailed Hazard Analysis of WMEC-270 Small Boat Operations, Attachment E: Detailed Hazard Analysis of WLIC-160 Deck Operations, and Attachment F: Risk-based Safety Survey of a WHEC-378 Vessel.

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Attachment B

Coarse Hazard Analysis of a WMEC-210 Vessel in Support of the Paragon Project

This attachment contains the results of the most recent coarse risk analysis (formerly called coarse hazard analysis) performed on a Coast Guard vessel (WMEC-210). Included are typical results produced by the analysis and the raw data collected during the analysis sessions with the subject matter experts. The analysis supported an actual operational requirement and was lead by personnel from MLC-LANT.

COARSE HAZARD ANALYSIS OF A WMEC-210 VESSEL IN SUPPORT OF THE PARAGON PROJECT

A Product of the United States Coast Guard Research and Development Center

Prepared by
JBF Associates, Inc.

December 1997

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This work was performed by JBF Associates, Inc. (JBFA-101-05-04.1-94) for the United States Coast Guard under Delivery Order DTCG39-97-F-E00128 of Contract Number DTCG39-95-F-E00395.

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ABSTRACT

This report documents a coarse hazard analysis of the United States Coast Guard (Coast Guard) WMEC-210 in support of the Paragon project. The analysis was performed using the Integrated Risk Assessment coarse hazard analysis methodology. Personnel from the Maintenance and Logistics Command — Atlantic Health and Safety Office and JBF Associates, Inc. performed the analysis. Coast Guard personnel from the *USCGC VENTUROUS* served as subject matter experts for the analysis.

The coarse hazard analysis provides (1) quantitative risk results for WMEC-210 operations and (2) recommendations for reducing risk (the analysis generated 60 risk reduction recommendations). The analysis focused on operations of interest to the Paragon project. The Paragon project is a study within the Coast Guard to analyze the effects of workforce reductions on Coast Guard cutters. The operations reviewed in this coarse hazard analysis are those believed to be most significantly impacted by the crew reductions. The purpose of the analysis is to establish a baseline risk of these operations that can be compared with the risk of the operations after the crew reductions have taken place on the project test platform.

SUMMARY

This report documents a coarse hazard analysis of a United States Coast Guard (Coast Guard) WMEC-210 vessel in support of the Paragon project. The analysis was performed using the Integrated Risk Assessment coarse hazard analysis methodology. Personnel from the Maintenance and Logistics Command — Atlantic Health and Safety Office and JBF Associates, Inc. performed the analysis. Coast Guard personnel from the *USCGC VENTUROUS* served as subject matter experts for the analysis. The analysis focused on operations of interest to the Paragon project. The Paragon project is a study within the Coast Guard to analyze the effects of workforce reductions on its cutters. The operations reviewed in this coarse hazard analysis are those believed to be most significantly impacted by the crew reductions. The purpose of the analysis is to establish a baseline risk of these operations that can be compared with the risk of the operations after the crew reductions have taken place on the project test platform.

The Paragon project scope did not include all operations/evolutions of a WMEC-210. Therefore, the analysis results do not represent the entire risk associated with a WMEC-210.

The analysis produced 60 risk reduction recommendations specific to WMEC-210 vessels. (The amount of risk reduction attributed to each recommendation was not assessed in this analysis.)

The total risk index number (RIN) for the WMEC-210 operations/evolutions within the scope of the Paragon project is approximately 13. It is important to note that the total RIN in this report does not represent the entire risk associated with a WMEC-210 because some of the operations/evolutions were not within the scope of the Paragon project. Table S.1 presents the mishap class frequencies identified in the analysis. Table S.1 also provides an expected time between mishap events.

Table S.1 Frequency Analysis Results for WMEC-210 (Paragon Project Scope)

Unit	Frequency Bounds for Mishaps (per year)			Expected Time Between Mishap Events		
	A/B	C	D	A/B	C	D
WMEC-210	0.06 to 0.6	0.87 to 8.7	28.4 to 284	~17 years to ~20 months	~14 months to ~6 weeks	~2 weeks to ~31 hours

The mishap categories (Class A, B, C, and D) in Table S.1 are consistent with the health and safety categories defined by the Coast Guard. In addition, these categories have been expanded to include economic, mission, and environmental impacts.

Figure S.1 and Figure S.2 present the risk contribution (percent of total risk) of the operations/evolutions and functions within the scope of this analysis, respectively.

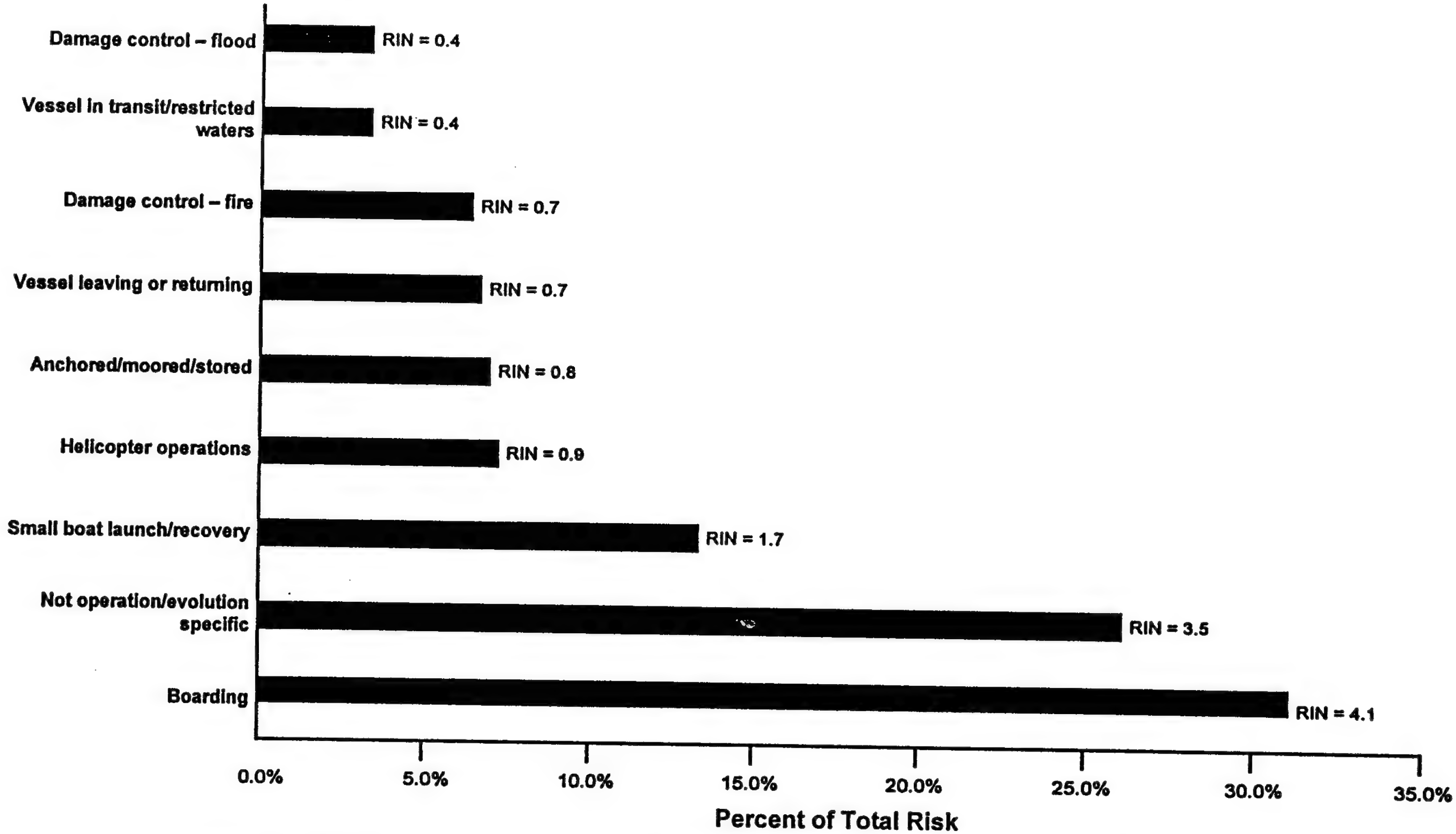
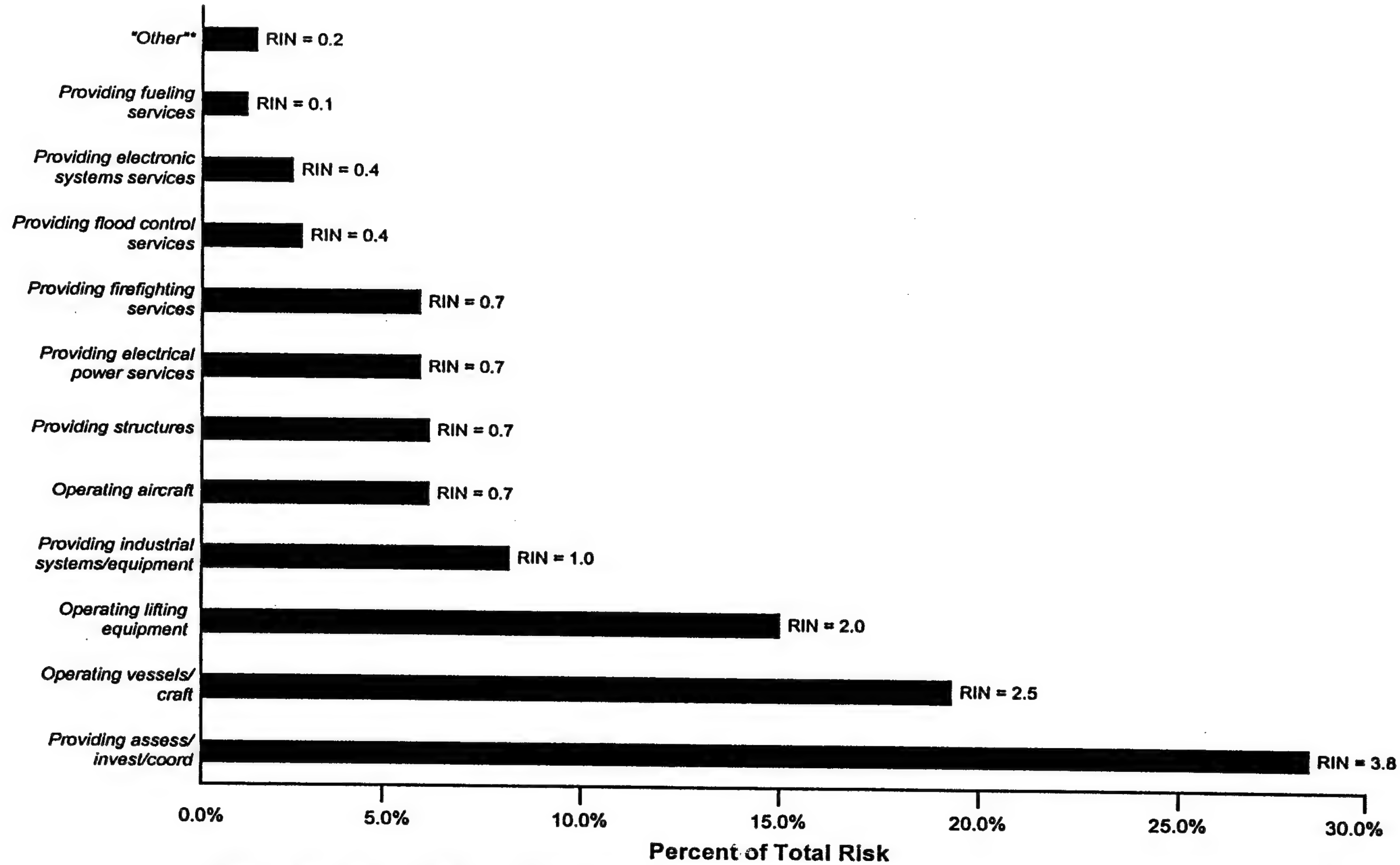


Figure S.1 Risk Contribution of Operations/Evolutions for WMEC-210 (Paragon Project Scope)



*"Other" contains lower risk functions. The following functions are included: *providing warehousing services, providing security services, providing small caliber weapons and other weapons*, and *providing food services*.

Figure S.2 Risk Contribution of Functions for WMEC-210 (Paragon Project Scope)

1. INTRODUCTION

This report documents a coarse hazard analysis of a United States Coast Guard (Coast Guard) WMEC-210 vessel in support of the Paragon project using the Integrated Risk Assessment (IRA) coarse hazard analysis methodology (Reference 1). Personnel from the Maintenance and Logistics Command — Atlantic Health and Safety Office (MLC-LANT) and JBF Associates, Inc. performed the analysis. Coast Guard personnel from the *USCGC VENTUROUS* served as subject matter experts for the analysis. Table 1.1 lists the personnel involved in the analysis.

Table 1.1 Coarse Hazard Analysis Team Members

Individual	Organization	Responsibility
USCGC VENTUROUS Personnel	*USCGC VENTUROUS*	Subject matter experts
CWO3 Paul Leach	MLC-LANT (kse)	Analysis leader
HSCS Glenn Sheridan	MLC-LANT (kse)	Analysis leader
Andrew M. Huff	JBF Associates, Inc.	Documentation
Thomas F. Zanin	JBF Associates, Inc.	Documentation

The coarse hazard analysis provides (1) quantitative risk results for WMEC-210 operations and (2) recommendations for reducing risk (the analysis generated 60 risk reduction recommendations). The analysis focused on operations of interest to the Paragon project. The Paragon project is a study within the Coast Guard to analyze the effects of workforce reductions on its cutters. The operations reviewed in this coarse hazard analysis are those believed to be most significantly impacted by the crew reductions. The purpose of the analysis is to establish a baseline risk of these operations that can be compared with the risk of the operations after the crew reductions have taken place on the project test platform.

The Paragon project scope did not include all operations/evolutions of a WMEC-210. Therefore, the analysis results do not represent the entire risk associated with a WMEC-210.

To assist the reader of this report, operations/evolutions are presented in bold type (e.g., **boarding**), functions are presented in italicized type (e.g., *operating vessels/craft*), and deviation types are presented in regular type (e.g., physical hazards exposure).

2. UNIT AND OPERATIONS

WMEC-210 cutters perform a variety of missions for the Coast Guard, including fisheries law enforcement, search and rescue, drug interdiction, migrant operations, and defense readiness. The *USCGC VENTUROUS* is based in St. Petersburg, Florida, and typically operates in the Gulf of Mexico and in Carribean waters.

3. *SCOPE OF THE COARSE HAZARD ANALYSIS*

The team analyzed WMEC-210 operations/evolutions of interest to the Paragon project. It is important to note that not all operations/evolutions applicable to WMEC-210s were analyzed. Table 3.1 presents the operations/evolutions and functions applicable to a WMEC-210 (denoted by a check in a cell). The shaded cells in Table 3.1 represent the operations/evolutions and functions addressed by the coarse hazard analysis team in this analysis. These operations/evolutions and functions included the operations/evolutions and functions within the scope of the Paragon project.

Because of time constraints, the hazard analysis team did not address all functions for each evaluated operation/evolution. However, the team did evaluate the functions judged in advance as being significantly impacted by the Paragon project and also those functions contributing significantly to the vessel's risk.

Table 3.1 Operations/Evolutions and Functions Matrix for WMEC-210*

MAJOR VESSEL FUNCTIONS	OPERATIONS/EVOLUTIONS												
							Small boat launch/ recovery						
	Towing	Boarding	Damage control — fire	Damage control — flood	Helicopter operations	Small boat operations	From land	From vessel	Anchored/ moored/stored	Vessel leaving or returning	Vessel in transit/ restricted waters	Launch/recover swimmers/divers	Not operation/ evolution specific (including open water maneuvering)
Operating vessels/craft	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓
Operating hand-operated moving equipment (dollies, carts, etc.)									✓			✓	✓
Operating lifting equipment	✓							✓	✓				✓
Operating aircraft (ground operations)					✓								
Providing/maintaining structures (buildings, piers, vessels, craft, etc.)													✓
Providing industrial systems/equipment	✓									✓			✓
Providing large caliber weapons		✓											✓
Providing small caliber weapons and other weapons		✓											✓
Providing electronic systems services													✓

*A check in a cell denotes that the operation/evolution and function are applicable to a WMEC-210. Shaded cells were within the analysis scope.

Table 3.1 Operations/Evolutions and Functions Matrix for WMEC-210* (cont'd)

MAJOR VESSEL FUNCTIONS	OPERATIONS/EVOLUTIONS												
	Towing	Boarding	Damage control — fire	Damage control — flood	Helicopter operations	Small boat operations	Small boat launch/ recovery: From land	Small boat launch/ recovery: From vessel	Anchored/ moored/stored	Vessel leaving or returning	Vessel in transit/ restricted waters	Launch/recover swimmers/divers	Not operation/ evolution specific (including open water maneuvering)
Providing electrical power services					✓				✓				✓
Providing fueling services					✓				✓				✓
Providing ballasting services													✓
Providing flood control services				✓									
Providing potable water services									✓				✓
Providing drainage services									✓				✓
Providing heating/ventilating/air conditioning services													✓
Providing trash removal services									✓				✓
Providing compressed air services												✓	✓
Providing compressed gas services													✓
Providing sewage services									✓				✓

*A check in a cell denotes that the operation/evolution and function are applicable to a WMEC-210. Shaded cells were within the analysis scope.

Table 3.1 Operations/Evolutions and Functions Matrix for WMEC-210* (cont'd)

MAJOR VESSEL FUNCTIONS	OPERATIONS/EVOLUTIONS												
							Small boat launch/ recovery						
	Towing	Boarding	Damage control — fire	Damage control — flood	Helicopter operations	Small boat operations	From land	From vessel	Anchored/ moored/stored	Vessel leaving or returning	Vessel in transit/ restricted waters	Launch/recover swimmers/divers	Not operation/ evolution specific (including open water maneuvering)
Providing food services													✓
Providing berthing services													✓
Providing steam services													✓
Providing medical services													✓
Providing recreation services													✓
Providing administrative services													✓
Providing warehousing services									✓				✓
Providing fire services			✓										
Providing security services									✓				✓
Providing assessment/investigation/ coordination services		✓							✓				✓

*A check in a cell denotes that the operation/evolution and function are applicable to a WMEC-210. Shaded cells were within the analysis scope.

4. *ANALYSIS APPROACH*

The WMEC-210 coarse hazard analysis was performed using the guidance of Reference 1. Table A.1 in Attachment A documents the coarse hazard analysis. This table is organized by operation/evolution and describes how deviations (upset conditions) may lead to mishaps (i.e., the deviation causes, safeguards, and mishaps of interest). The risk index numbers (RINs) characterizing the risk associated with each deviation are also listed in Table A.1. Reference 1 discusses the mishap categories and frequency categories listed in Table A.1. The frequency categories are shown in Figure 4.1. The mishap categories (Class A, B, C, and D mishaps) for health and safety losses are defined in the *USCG Safety and Environmental Health Manual* (Reference 2). The mishap categories have been expanded for use in the IRA process to include economic, mission, and environmental losses, as summarized in Table 4.1.

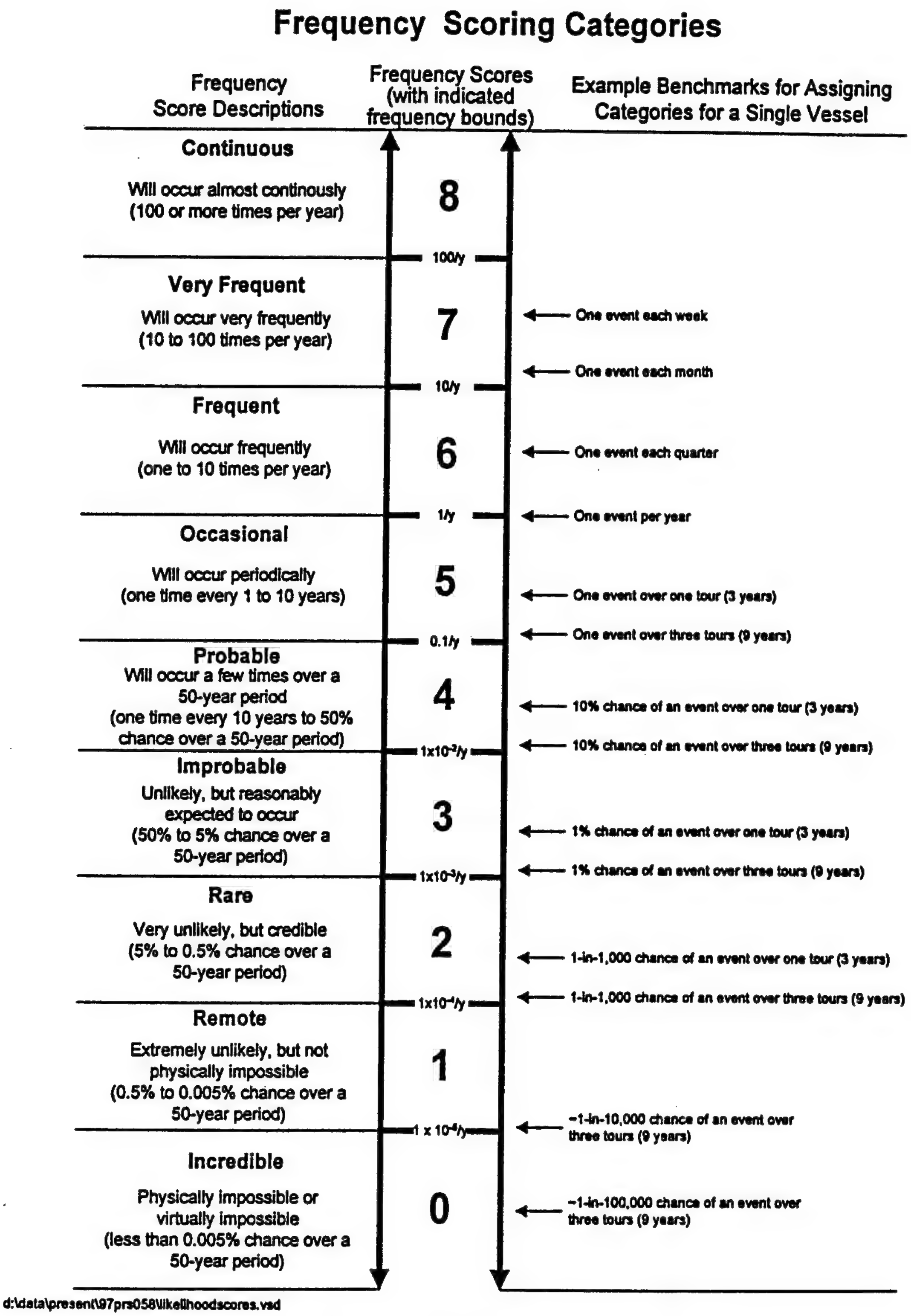


Figure 4.1 Frequency Scoring Categories

Table 4.1 Mishap Categories

Mishap Category	Safety	Economic	Mission	Environmental
Class A	A vessel is missing or abandoned, recovery is impossible or impractical, or the vessel cannot be repaired economically; an injury or illness results in a fatality or permanent total disability	The cost of reportable property damage is $1,000,000 or more	Major impact on ability of vessel/base to rapidly accomplish critical missions. Significant command attention	Major offsite impact (offsite health effects)
Class B	Any injury or illness results in permanent partial disability; five or more people are inpatient hospitalized	The cost of reportable property damage is $200,000 or more, but less than $1,000,000		
Class C	A nonfatal injury or illness results in loss of time from work beyond the day or shift on which it occurred	The cost of property damage is $10,000 or more, but less than $200,000	Moderate impact on ability of vessel/base to rapidly accomplish critical missions. Limited capabilities, but able to respond if needed	Significant offsite impact (community alert or awareness)
Class D	A nonfatal injury or illness occurs that does not meet the criteria of a Class C mishap; a person is overboard, an accidental firearm discharge occurs, or an electric shock occurs, none of which meets the criteria of a higher classification	The cost of property damage is less than $10,000	Minor impact on ability of vessel/base to rapidly accomplish critical missions. Operational nuisance	Onsite release of a substance with minor/no offsite effects

5. RESULTS

This section provides the analysis results for the risk information presented in Table 5.1. *In future reports, Table 5.1 will represent risk information selected through the IRA software.* An asterisk (*) in any of the cells of Table 5.1 indicates standard risk information that will be included in every IRA coarse hazard analysis report, unless the person requesting the report explicitly excludes the information. A check signifies information that is included in this report. Table 5.1 contains the following information options: (1) unit risk information, (2) detailed unit risk information, and (3) recommendation information.

Unit risk information includes (1) a risk matrix presenting the number of deviations the study identified as having a particular frequency score and mishap class, (2) a listing of high risk deviations, (3) a presentation of the cumulative or overall risk based on all deviations investigated, and (4) a comparison of unit results with Mishap Reporting (MISREP) data.

Detailed risk information includes information for the unit separated into (1) operation/evolution, (2) function, (3) location, and (4) deviation type. For example, by placing a check in the first space under the Bar Chart header, the user can request a bar chart showing the risk contribution of the various operations/evolutions addressed by the study. By placing a check in the first space under the Table of Dominant Deviations header, the user can request a table showing dominant deviations associated with the high risk operations/evolutions. If other detailed information is needed, the user can request a matrix showing operation/evolution by risk contribution of applicable functions, locations, or deviation types. For example, by placing a check in the space where Operation/Evolution and By Function intersect, the user can request a matrix presenting a breakdown of risk contribution results for operation/evolution by function.

Recommendation information includes options for selecting (1) a list of recommendations, (2) estimated risk impact of recommendations versus associated deviations, or (3) selected deviations versus estimated risk impact of associated recommendations.

Table 5.1 Risk Information Selected for This Report *(A check signifies the information is included in this report)*

UNIT RISK INFORMATION				
	Risk Matrix	**Most Significant Deviations**	**Overall Results (Frequency Bounds)**	**Comparison of Results with MISREP Data**
Unit Risk	✓* (Figure 5.1)	✓* (Table 5.2)	✓* (Table 5.3)	✓* (Table 5.4)

DETAILED UNIT RISK INFORMATION						
			Risk Contribution Matrix			
Breakdown of Unit	**Bar Chart**	**Table of Dominant Deviations**	**By Operation/ Evolution**	**By Function**	**By Location**	**By Deviation Type**
Operation/Evolution	✓* (Figure 5.2)	✓ (Table 5.5)				
Function	✓* (Figure 5.3)	✓ (Table 5.6)				
Location						
Deviation Type	✓* (Figure 5.4)	✓ (Table 5.7)		✓ (Table 5.8)		

RECOMMENDATION INFORMATION			
	Listing of Recommendations	**Estimated Risk Impact of Recommendations Versus Deviations**	**Selected Deviations Versus Estimated Risk Impact of Recommendations**
Recommendations	✓* (Section 7)	✓* (Table B.1)	✓ (Table B.2)

* Standard risk information included in every IRA coarse hazard analysis report.

5.1 VESSEL RISK

The total RIN for the WMEC-210 operations/evolutions within the scope of the Paragon project is approximately 13. This section provides detailed information about the vessel risk.

5.1.1 Risk Matrix

The risk matrix for a WMEC-210 (Paragon project scope; see note below) is shown in Figure 5.1. The shaded areas in Figure 5.1 represent risk categories below the screening criteria (relatively low risk; not evaluated in detail during the analysis). Not all deviations addressed by the analysis team are

reflected in Figure 5.1 because the team screened lower risk deviations from further study during the analysis (screening is described in Reference 1). The number in each cell of the matrix is the number of deviations with the frequency score and mishap class represented by the cell. For example, the cell corresponding to Frequent (6) and Class D Mishap indicates that 16 deviations were assessed as having a Class D Mishap frequency of 6.

NOTE: The risk matrix represents only the scope defined by the Paragon project. This analysis did not cover all operations/evolutions, functions, or deviations of a WMEC-210 and, therefore, represents only a partial risk profile of a WMEC-210.

	Class D Mishaps	Class C Mishaps	Class A/B Mishaps
Continuous (8)	–	–	–
Very Frequent (7)	1	–	–
Frequent (6)	16	–	–
Occasional (5)	24	7	–
Probable (4)		17	5
Improbable (3)			9
Rare (2)			42
Remote (1)			
Incredible (0)			

Figure 5.1 Risk Matrix for WMEC-210 (Paragon Project Scope)

5.1.2 High Risk Deviations

Table 5.2 presents a list of the high risk deviations for a WMEC-210 as indicated by their associated RINs (i.e., those with RINs greater than 0.6).

5.1.3 Overall Frequency Bounds for Mishaps

Table 5.3 summarizes the frequency bounds for Class A/B, Class C, and Class D mishaps for a WMEC-210. This information indicates (1) the expected frequency ranges in which mishaps will occur and (2) the expected time between mishap events for each mishap class. The mishap frequency bounds were determined using the information from Figure 5.1 and the upper and lower frequency bounds for each mishap frequency category (see Reference 1).

Table 5.2 High Risk Deviations† for WMEC-210 (Paragon Project Scope)

RIN (Risk Contribution)	Deviation*	Revised RIN‡
3.006 (22.8%)	**Boarding** *Providing assessment/investigation/coordination services* Physical hazards exposure (Item 3.3)	
0.9 (6.8%)	**Small boat launch/recovery** *Operating lifting equipment* Physical hazards exposure (Item 11.4)	
0.63 (4.8%)	**Not operation/evolution specific** *Providing electrical power services* Electrical hazards exposure (Item 23.7)	
0.63 (4.8%)	**Helicopter operations** *Operating aircraft* Aircraft unavailable (Item 7.1)	
0.63 (4.8%)	**Vessel leaving or returning** *Operating vessels/craft* Incorrect position/direction/speed (Item 16.2)	
0.6003 (4.6%)	**Not operation/evolution specific** *Providing industrial systems/equipment* Physical hazards exposure (Item 21.3)	
0.603 (4.6%)	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	

† The remaining deviations had risk contributions less than 3.0% of total vessel risk.
* The referenced item numbers in Table A.1 discuss the specific causes (including equipment failures, human errors, and external events), mishaps, and safeguards associated with these deviations.
‡ Revised RIN if all applicable recommendations are implemented. See Table B.2 for an assessment of applicable recommendations for these deviations. (Note: This exercise is outside the scope of the Paragon project.)

Table 5.3 Frequency Analysis Results for WMEC-210 (Paragon Project Scope)

	Frequency Bounds for Mishaps (per year)			Expected Time Between Mishap Events		
Unit	A/B	C	D	A/B	C	D
WMEC-210	0.06 to 0.6	0.87 to 8.7	28.4 to 284	~17 years to ~20 months	~14 months to ~6 weeks	~2 weeks to ~31 hours

5.1.4 Comparison of Analysis Results with MISREP Data

Table 5.4 compares the estimated frequency bounds for mishaps associated with a WMEC-210 to actual mishap frequencies based on MISREP data from the last 3.5 years.

Table 5.4 Comparison of Estimated Mishap Frequencies for WMEC-210 (Paragon Project Scope) with MISREP Data

	Estimated Frequency Bounds for Mishaps (per year)			Mishap Frequencies Based on Coast Guard (MISREP) Data (per year)[1]		
Unit	A/B	C	D	A/B[2]	C[3]	D[4]
WMEC-210	0.06 to 0.6	0.87 to 8.7	28.4 to 284	~0.02	~0.98	~1.4

[1] MISREP search was conducted for all WMEC-210s.
[2] Based on 0 Class A/B mishaps over 3.5 years (assumed < 1 mishap/3.5 years/16 vessels).
[3] Based on 55 Class C mishaps over 3.5 years (55 mishaps/3.5 years/16 vessels).
[4] Based on 81 Class D mishaps over 3.5 years (81 mishaps/3.5 years/16 vessels).

5.2 RESULTS FOR SELECTED RISK INFORMATION TYPES

This section presents results (in Figures 5.2 through 5.4 and Tables 5.5 through 5.8) for the risk information types selected in Table 5.1. The coarse hazard analysis recommendations are presented in Section 7.

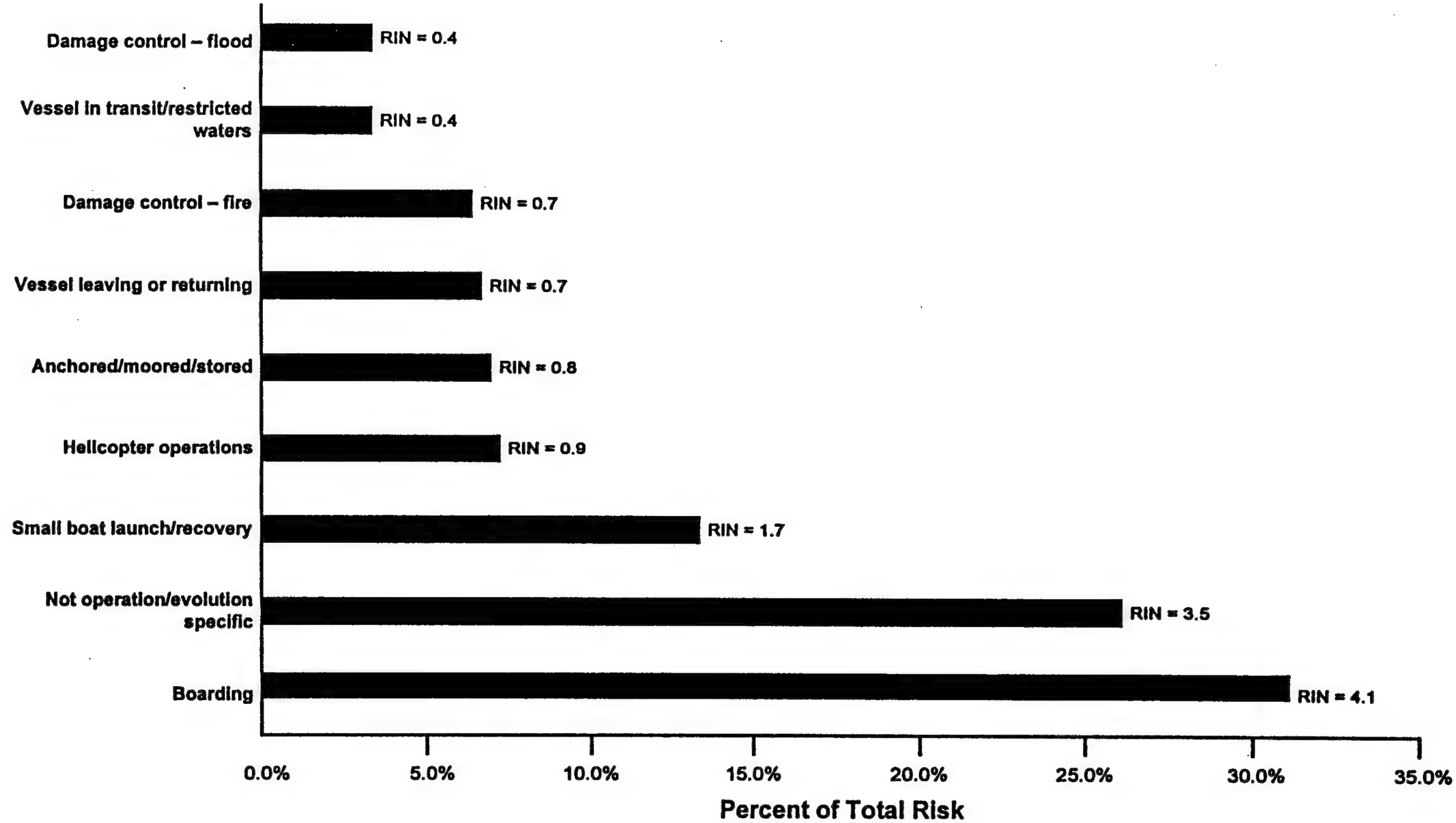


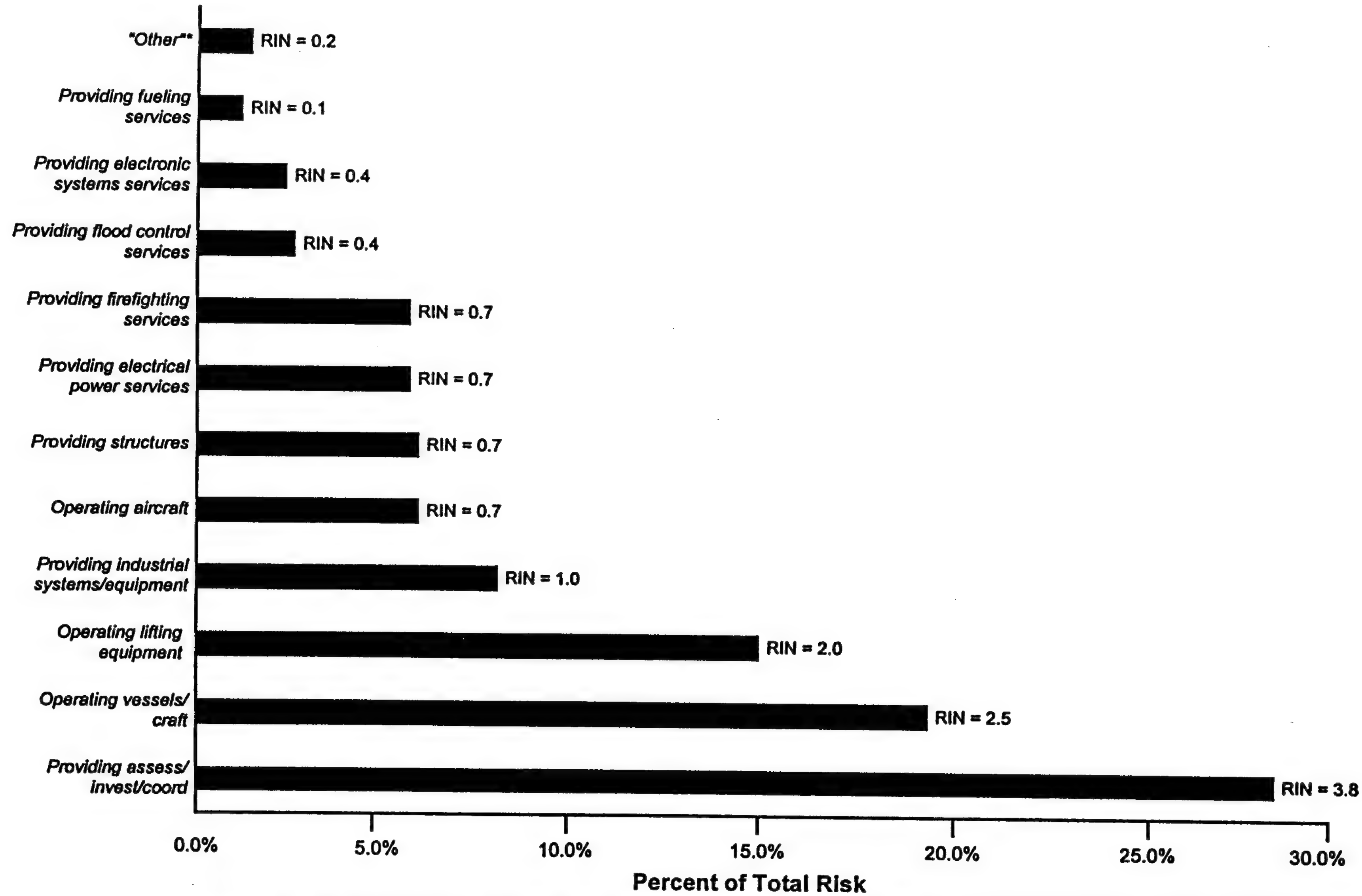
Figure 5.2 Risk Contribution of Operations/Evolutions for WMEC-210 (Paragon Project Scope)

Table 5.5 High Risk Operations/Evolutions

Operations/Evolutions Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Operation/Evolution Risk	Deviation Risk Contribution to Operation/Evolution
Boarding	31.3%	**Boarding** *Providing assessment/investigation/coordination services* Physical hazards exposure (Item 3.3)	73%
		Boarding *Operating vessels/craft* Physical hazards exposure (Item 1.7)	9%
Not operation/evolution specific	26.4%	**Not operation/evolution specific** *Providing electrical power services* Electrical hazards exposure (Item 23.7)	18%
		Not operation/evolution specific *Providing industrial systems/equipment* Physical hazards exposure (Item 21.3)	17%
		Not operation/evolution specific *Providing electronic systems services* Electronic systems service quality problem (Item 22.2)	10%
		Not operation/evolution specific *Providing/maintaining structures* Physical hazards exposure (Item 20.4)	10%
		Not operation/evolution specific *Operating lifting equipment* Loss of support (Item 19.2)	9%
		Not operation/evolution specific *Operating lifting equipment* Physical hazards exposure (Item 19.4)	9%
		Not operation/evolution specific *Providing/maintaining structures* Toxic/corrosive/reactive materials exposure (Item 20.5)	9%

Table 5.5 High Risk Operations/Evolutions (cont'd)

Operations/Evolutions Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Operation/Evolution Risk	Deviation Risk Contribution to Operation/Evolution
Small boat launch/recovery	13.1%	**Small boat launch/recovery** *Operating lifting equipment* Physical hazards exposure (Item 11.4)	52%
		Small boat launch/recovery *Operating vessels/craft* Incorrect position/direction/speed (Item 10.2)	21%
		Small boat launch/recovery *Operating lifting equipment* Lifting equipment unavailable (Item 11.1)	19%
Helicopter operations	6.6%	**Helicopter operations** *Operating aircraft* Aircraft unavailable (Item 7.1)	73%
		Helicopter operations *Providing fueling services* Fuel quality problem (Item 9.2)	10%
Anchored/moored/ stored	6.0%	**Anchored/moored/ stored** *Operating vessels/craft* Vessel struck by another vessel (Item 12.6)	46%
		Anchored/moored/ stored *Providing assessment/investigation/coordination services* Inadequate/no assessment/investigation/coordination (Item 14.1)	46%



*"Other" contains lower risk functions. The following functions are included: *providing warehousing services, providing security services, providing small caliber weapons and other weapons*, and *providing food services.*

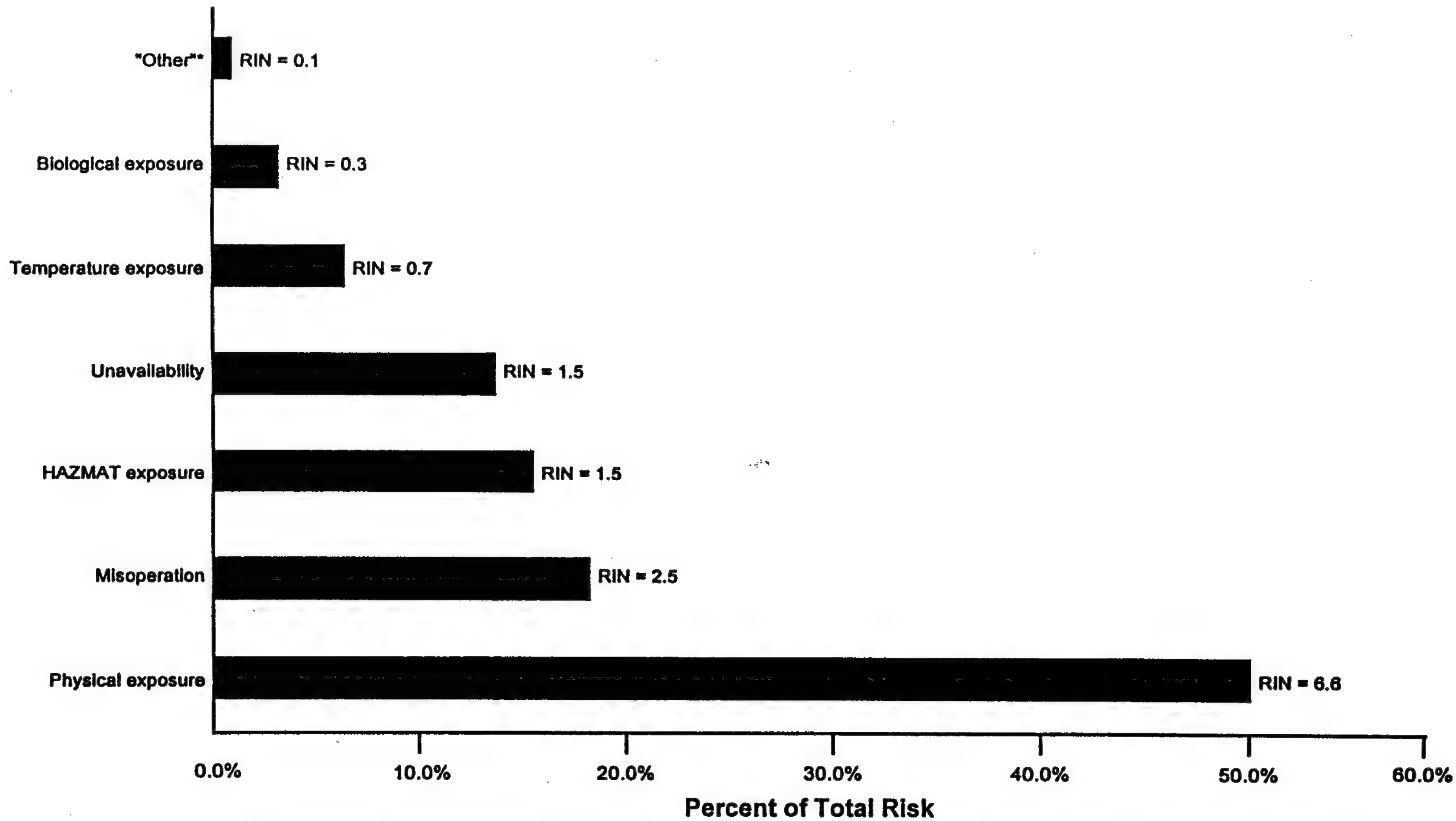
Figure 5.3 Risk Contribution of Functions for WMEC-210 (Paragon Project Scope)

Table 5.6 High Risk Functions

Functions Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Function Risk	Deviation Risk Contribution to Function
Providing assessment/ investigation/ coordination services	29.1%	**Boarding** *Providing assessment/investigation/coordination services* Physical hazards exposure (Item 3.3)	78%
		Anchored/moored/stored *Providing assessment/investigation/coordination services* Inadequate/no assessment/investigation/coordination services (Item 14.1)	9%
Operating vessels/craft	18.9%	**Vessel leaving or returning** *Operating vessels/craft* Incorrect position/direction/speed (Item 16.2)	25%
		Anchored/moored/stored *Operating vessels/craft* Vessel struck by another vessel (Item 12.6)	14%
		Boarding *Operating vessels/craft* Physical hazards exposure (Item 1.7)	14%
		Small boat launch/recovery *Operating vessels/craft* Incorrect position/direction/speed (Item 10.2)	14%
		Boarding *Operating vessels/craft* Hot/cold environments exposure (Item 1.17)	12%
		Vessel in transit/restricted waters *Operating vessels/craft* Hot/cold environments exposure (Item 17.17)	12%

Table 5.6 High Risk Functions (cont'd)

Functions Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Function Risk	Deviation Risk Contribution to Function
Operating lifting equipment	15%	**Small boat launch/recovery** *Operating lifting equipment* Physical hazards exposure (Item 11.4)	45%
		Small boat launch/recovery *Operating lifting equipment* Lifting equipment unavailable (Item 11.1)	17%
		Not operation/evolution specific *Operating lifting equipment* Loss of support (Item 19.2)	15%
		Not operation/evolution specific *Operating lifting equipment* Physical hazards exposure (Item 19.4)	15%
Providing industrial systems/equipment	7.6%	**Not operation/evolution specific** *Providing industrial systems/equipment* Physical hazards exposure (Item 21.3)	60%
		Not operation/evolution specific *Providing industrial systems/equipment* Toxic/corrosive/reactive materials exposure (Item 21.4)	31%
Operating aircraft	5.4%	**Helicopter operations** *Operating aircraft* Aircraft unavailable (Item 7.1)	88%
Providing structures	5.4%	**Not operation/evolution specific** *Providing/maintaining structures* Physical hazards exposure (Item 20.4)	47%
		Not operation/evolution specific *Providing/maintaining structures* Toxic/corrosive/reactive materials exposure (Item 20.5)	43%



*"Other" contains lower risk deviation types. The following deviation types are included: noise/vibration exposure, weapons issues, radiation exposure, and structural problems.

Figure 5.4 Risk Contribution of Deviation Types for WMEC-210 (Paragon Project Scope)

Table 5.7 High Risk Deviation Types

Deviation Types Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Deviation Type Risk	Deviation Risk Contribution to Deviation Type
Physical hazards exposure	50.2%	**Boarding** *Providing assessment/investigation/coordination services* Physical hazards exposure (Item 3.3)	45.5%
		Small boat launch/recovery *Operating lifting equipment* Physical hazards exposure (Item 11.4)	13.6%
		Damage control — fire *Providing fire services* Physical hazards exposure (Item 4.3)	9.1%
		Not operation/evolution specific *Providing industrial systems/equipment* Physical hazards exposure (Item 21.3)	9.1%
		Boarding *Operating vessels/craft* Physical hazards exposure (Item 1.7)	5.4%
Misoperation	18.7%	**Vessel leaving or returning** *Operating vessels/craft* Incorrect position/direction/speed (Item 16.2)	25.6%
		Anchored/moored/stored *Operating vessels/craft* Vessel struck by another vessel (Item 12.6)	14.6%
		Not operation/evolution specific *Providing electronic systems services* Electronic systems service quality problem (Item 22.2)	14.6%
		Small boat launch/recovery *Operating vessels/craft* Incorrect position/direction/speed (Item 10.2)	14.6%
		Not operation/evolution specific *Operating lifting equipment* Loss of support (Item 19.2)	12.4%

Table 5.7 High Risk Deviation Types (cont'd)

Deviation Types Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Deviation Type Risk	Deviation Risk Contribution to Deviation Type
HAZMAT exposure	11.8%	**Not operation/evolution specific** *Providing electrical power services* Electrical hazards exposure (Item 23.7)	40.9%
		Not operation/evolution specific *Providing/maintaining structures* Toxic/corrosive/reactive materials exposure (Item 20.5)	19.8%
		Not operation/evolution specific *Providing industrial systems/equipment* Toxic/corrosive/reactive materials exposure (Item 21.4)	19.8%

Table 5.8 Risk Contribution of Deviation Types by Function for WMEC-210*

Deviation Type	Function											Total†
	Operating vessels/craft	*Operating lifting equipment*	*Operating aircraft*	*Providing electronic systems services*	*Providing electrical power services*	*Providing fueling services*	*Providing flood control services*	*Providing fire services*	*Providing assessment/ investigation/ coordination services*	*Providing structures*	*Providing industrial systems/ equipment*	
Physical exposure	2.7%	9.2%	0.0%	—	—	—	2.8%	4.6%	22.8%	2.5%	5.2%	50.2%
Misoperation	11.6%	2.8%	0.1%	2.7%	0.0%	0.7%	—	—	0.7%	—	—	18.7%
HAZMAT exposure	—	0.1%	0.0%		4.8%	0.3%	0.1%	0.6%	0.5%	2.6%	2.3%	11.8%
Unavailability	—	2.5%	4.8%	0.0%	0.5%	0.0%	—	—	2.7%	—	—	11.0%
Temperature exposure	4.6%	0.5%	—	—	—	—	0.1%	—	—	0.3%	—	5.4%
Biological exposure	—	—	—	—	—	—	—	—	2.3%	—	—	2.3%
Noise/vibration exposure	—	—	0.5%	—	—	—	—	—	—	—	—	0.5%
Weapons issues	—	—	—	—	—	—	—	—	—	—	—	0.0%
Radiation exposure	—	—	—	—	—	—	—	—	—	—	—	0.0%
Structural problems	—	—	—	—	—	—	—	—	—	0.0%	—	0.0%

* Table values are percentages of overall vessel risk (based on an RIN of 13). Functions contributing less than 1% to overall facility risk are not listed. A dash means the deviation type was not analyzed for the function. Zero percent means that the percentage was less than 0.1%.
† The totals will not sum to 100% since functions contributing less than 1% to overall facility risk are not listed in the table.

6. OBSERVATIONS

This section presents observations on the coarse hazard analysis results.

6.1 ANALYSIS SCOPE OBSERVATIONS

The coarse hazard analysis addressed the operations/evolutions identified as being impacted by the Paragon project. However, not all of the operations/evolutions of a WMEC-210 were analyzed (e.g., **towing**). Therefore, this analysis does not present a complete picture of the WMEC-210 risk. The analysis does provide information that should support meaningful risk management decisions for the Paragon project, and the information can be useful in managing the risk of the operations/evolutions analyzed.

6.2 RISK OBSERVATIONS FOR VESSELS

- The risk matrix in Figure 5.1 shows a distribution of potential Class A/B, Class C, and Class D mishaps. When reviewing Figure 5.1, note that the number of potential mishaps decreases on a straight line as mishap severity increases (the line is an imaginary one [of constant risk] running from upper left to lower right), with the majority of potential Class A/B mishaps being even lower than an imagined line would suggest (indicating an emphasis on reducing large consequence mishaps). This type of result is common for a vessel class that has been operated for a relatively long time and has focused on preventing very significant or very frequent mishaps. It is important to remember that this matrix represents only operations/evolutions within the Paragon scope and not an entire WMEC-210.

- As seen in Table 5.2, vessel risk within the Paragon scope is dominated by the "physical hazards exposure" deviation associated with **boarding** (~23% of the total risk). *USCGC VENTUROUS* personnel expected **boarding** and **small boat launch/recovery** to be the high risk operations (a vast majority of small boat operations support **boarding** operations). The analysis results validated their expectations, and coincided with the coarse hazard analysis results of the WHEC-378 vessel class (which also identified the physical hazards associated with **boarding** as the dominant risk contributor).

- The expected frequency of mishap events shown in Table 5.3 (frequency analysis results) appears to be reasonable for the type of operations performed by the WMEC-210. If the scope of the analysis had included all WMEC-210 operations/evolutions, the frequencies in Table 5.3 would have been higher.

- Comparing the team's estimated mishap frequencies with actual mishap frequencies derived from MISREP data (Table 5.4), the team's estimates are slightly higher than those found in the MISREP database (significantly higher for Class D mishaps). A couple of factors may influence the discrepancy between analysis results and MISREP data:

  (1) Minor equipment damage or physical injuries (Class D mishaps) may often go unreported by personnel

  (2) The team may have been influenced by recent mishap events, causing them to overestimate mishap event frequencies and assign higher frequency scores during the analysis

It should be noted that if the analysis were to include all operations/evolutions for a WMEC-210, the discrepancy in the data could be larger.

6.3 RISK OBSERVATIONS FOR OPERATIONS/EVOLUTIONS

Boarding and **not operation/evolution specific** are the dominant operations/evolutions in this analysis (Figure 5.2). Together they account for ~57% of total risk (Paragon project scope).

- The risk associated with **boarding** (Table 5.5) is dominated by "physical hazards exposure" related to *providing assessment/investigation/coordination services*. This activity includes transferring between the small boat and the subject vessel and performing an assessment on the subject vessel

- **Not operation/evolution specific** includes all of the activities that are not specific to an operation/evolution. Table 5.5 shows that the risk associated with **not operation/evolution specific** is dominated by "electrical hazards exposure" related to maintaining the power distribution system and "physical hazards exposure" related to operating/maintaining mechanical equipment on the vessel

6.4 RISK OBSERVATIONS FOR FUNCTIONS

Providing assessment/investigation/coordination services, *operating vessels/craft*, and *operating lifting equipment* are the dominant risk contributing functions in this analysis (Figure 5.3). Together they account for ~63% of total risk (Paragon project scope).

- Table 5.6 shows that the main contributor to the risk associated with *providing assessment/ investigation/coordination services* is "physical hazards exposure" related to the **boarding** operation (mainly unloading and loading from the small boat while at the subject vessel and performing an assessment on the subject vessel)

- The main contributor (Table 5.6) to the risk associated with *operating vessels/craft* is related to maneuvering the WMEC-210 during mooring and getting underway

- The main contributor (Table 5.6) to the risk associated with *operating lifting equipment* is "physical hazards exposure" related to launching and recovering the small boat. This includes physical injury to personnel operating/maintaining the launch and recovery equipment, as well as members of the boarding team as they load and unload from the small boat while at the cutter

6.5 RISK OBSERVATIONS FOR DEVIATION TYPES

"Physical hazards exposure" deviations are the dominant contributors to risk in this analysis (Figure 5.4). This deviation type accounts for ~50% of the total risk (Paragon project scope). Table 5.7 shows that "physical hazards exposure" during the **boarding** and **small boat launch/recovery** operations are the highest risk deviations within this deviation type.

7. *RECOMMENDATIONS*

The following are the recommendations developed by the WMEC-210 coarse hazard analysis team to help reduce the risks of potential mishaps. Table B.1 provides the recommendations and associated operations/evolutions, functions, and deviations. This table can be used for determining the potential risk reduction if the recommendations are implemented.

Recommendation 1 — *Consider researching the benefits of the vessel tracking system (VTS) to understand the value of VTS in ports where the service is established.* The VTS is only in use in certain ports, and its benefits should be researched to determine if it should be installed in all major U.S. ports.

Recommendation 2 — *Consider mandating the use of tugs/pusher boats in mooring/unmooring operations.* Using these boats can lower the likelihood of accidents due to misjudgment of local conditions, unfamiliarity with local conditions, and using ships' propulsion close to the pier.

Recommendation 3 — *Consider promoting a better understanding of navigation rules among recreational boaters.* Recreational boaters have habitually been a source of problems during vessel transits.

Recommendation 4 — *Consider implementing a more expedient form of communications between the bridge and the deck during line handling evolutions.* Currently, communications are Officer of the Deck (OOD) to bridge phone talker, bridge phone talker to deck phone talker, and deck phone talker to deck supervisor.

Recommendation 5 — *Consider increasing the frequency of line handling evolution training.* Due to the rotation of experienced deck personnel, experienced line handlers are often scarce. This forces newly qualified personnel or personnel being trained (under supervision) to accomplish a large number of deck tasks during **mooring/unmooring** evolutions. The training outlined in the *Cutter Training and Qualification Manual* serves as the basis for this training and should be conducted on deck (simulated line handling) as much as possible.

Recommendation 6 — *Consider promoting the use of local ship-driving simulators for training vessel personnel.* The Coast Guard has a simulator in New London, but it may not be readily accessible. Using local simulators may prove beneficial, especially for training under local conditions.

Recommendation 7 — *Consider performing additional walkthrough evolutions for damage control with only a limited amount of equipment before conducting walkthrough evolutions with full damage control equipment.* Personnel occasionally experience physical injuries during **training** evolutions, and conducting limited equipment walkthroughs may reduce physical hazards exposure.

Recommendation 8 — *Consider medically screening for claustrophobia those vessel personnel assigned to damage control duties.* Damage control operations are occasionally hindered because personnel with claustrophobia are limited in performing in some damage control environments.

Recommendation 9 — *Consider additional damage control cross-training for vessel personnel.* Currently, certain vessel personnel receive only minimal damage control training. More cross-training will increase the effectiveness of damage control.

Recommendation 10 — *Consider using local firefighting training facilities for training vessel personnel in damage control events.* Using local facilities exposes personnel to realistic fire scenarios and should be cost effective due to the proximity of the facilities to the vessel.

Recommendation 11 — *Consider promoting shipboard familiarization visits by local fire departments.* This will increase damage control capabilities of local fire departments if they need to respond to a vessel.

Recommendation 12 — *Consider incorporating safety and damage control inspections with material inspections and increasing the frequency of these inspections.* Material inspections are being performed periodically, but safety and damage control inspections are not being performed as frequently. Combining all elements into a single inspection will more efficiently use personnel time and should increase the likelihood of identifying safety and damage control deficiencies.

Recommendation 13 — *Consider developing Tailored Shipboard Training Assessment (TSTA) damage control scenarios that require numbers of personnel more in line with expected vessel manning.* Current TSTA scenarios require more personnel for damage control scenarios than are normally expected to be available to fight damage control events.

Recommendation 14 — *Consider using portable AFFF extinguishers on board vessels.* Portable AFFF extinguishers allow personnel to respond faster to Class B fires and lower the physical hazard exposure from running AFFF hoses around engineering spaces.

Recommendation 15 — *Consider enhancing all-hands training (in-port training) to include reporting unusual vessel traffic or nearby vessels getting underway to the OOD.* This will help the OOD be aware of local traffic and take timely corrective action when needed.

Recommendation 16 — *Consider sending additional vessel personnel to basic damage control school (flooding school).* Vessel personnel are not sent to many flooding control schools, and this will improve vessel capability in fighting flooding.

Recommendation 17 — *Once new personnel are identified for sea duty, consider sending them to some type of damage control training before arriving at a vessel.* This will provide basic damage control

awareness for all new vessel personnel. Consider areas of training such as watertight door boundary conditions, fire hoses use, breathing apparatus, flooding control, clothing requirements, damage control discrepancy prevention, etc.

Recommendation 18 — *Consider more frequent training on identifying and handling hazardous materials (HAZMAT).* This will increase vessel-wide hazard communication/handling and will support damage control efforts.

Recommendation 19 — *Consider enhancing HAZMAT training to include training all hands on hazardous materials found in each compartment.* A listing like this exists for supporting damage control efforts. This training would increase hazardous materials awareness for routine vessel activities and for damage control scenarios. The training should be performed on a periodic basis.

Recommendation 20 — *Consider using thermal imager and O_2 sampler mock-ups instead of actual equipment during damage control drills.* This would reduce equipment damage during damage control drills.

Recommendation 21 — *Consider not grading TSTA or underway drills.* Grading scores should be overall damage control capability scores aimed at accomplishing damage control functions instead of a point system. The current point system causes vessels to repeatedly run damage control (perhaps to excess), thus exposing personnel to injury and possibly damaging equipment.

Recommendation 22 — *Consider requiring that inport OODs establish communications with nearby vessels or local port authorities.* This will help the vessel OOD be aware of vessel traffic and vessel activities (e.g., divers in the water) near the vessel and take timely corrective action when needed.

Recommendation 23 — *Consider establishing standard procedures for requesting local assistance (domestic and foreign) and establishing specific vessel security measures for increased security situations (consistent with Coast Guard Threat Con levels).* This will streamline security decisions and lower uncertainty of OODs in responding to security matters. This should include procedures for establishing security for different vessel manning levels while in port.

Recommendation 24 — *Consider increasing the use of remote alarm systems on critical vessel systems and increasing the number of alarm channels for existing alarm systems (e.g., multiple flooding alarm levels for each monitored bilge).* This would reduce the need for roving watchstanders to physically check all vessel spaces and may reduce fatigue on watchstanders (who may already be fatigued from duty responsibilities), or may reduce the number of required watchstanders.

Recommendation 25 — *Consider monitoring CASREP reports for equipment/system failure trends.* This will assist vessel personnel in monitoring/checking/maintaining potential problem areas on their vessels. Elements of this may be currently captured in the Configuration Management Plus system.

Recommendation 26 — *Consider performing quality assurance checks on the accuracy of the electrical securing schedule after maintenance periods.* This will reduce the chance of electrical shock during damage control or maintenance activities.

Recommendation 27 — *Consider sending more vessel damage control personnel to Damage Control Petty Officer School (DCPO School).* This Navy school would increase damage control awareness for vessel personnel, especially during structural maintenance/inspection.

Recommendation 28 — *Consider increasing the availability of the Material Assistance Team (MAT) and the Naval Engineering Support Unit (NESU) teams for vessel support in vessel downsizing.* The vessel currently uses these resources (engineering, damage control, and electronics), and may need them even more if vessel personnel manning is reduced.

Recommendation 29 — *Consider periodically training the helicopter team on the use and hazards of the hot start equipment.* Personnel had not seen the equipment used and were unfamiliar with its use.

Recommendation 30 — *Consider establishing on-duty time limits (such as those established for pilots) for helicopter crew members to reduce fatigue during helicopter operations.* Helicopter operations often require a significant amount of working hours from the helicopter crew. Establishing time limits can help reduce fatigue-related accidents.

Recommendation 31 — *Consider improving the technical support for cranes and davits such as sending personnel to maintenance classes and acquiring the current technical manuals, schematics, and operating instructions for the cranes and davits.* Maintenance is difficult due to the lack of lifting system information. Operation of the lifting system and maintenance response time can be improved with better technical support.

Recommendation 32 — *Consider ways to simplify the electrical and mechanical system of the cranes and davits to improve the reliability of the systems.* These systems require frequent maintenance and should be modified or redesigned to reduce maintenance tasks and periodicity.

Recommendation 33 — *Consider periodically load testing the fiberglass around the lifting eyes on the small boats to determine if there is any degradation that can lead to a structural failure.* The fiberglass on the small boat will degrade over time, and a method to monitor the degradation would help prevent unanticipated failures.

Recommendation 34 — *Consider requiring formal training for small boat equipment inspectors or using certified inspectors.* Inspection of lifting equipment should be performed by experienced personnel to ensure that subtle problems with the lifting equipment are detected.

Recommendation 35 — *Consider weight testing the Motor Surf Boat (MSB) on a yearly basis to determine if the MSB is retaining water and increasing in weight.* Over the life of an MSB, the MSB will retain water and increase in weight. This should be periodically checked to ensure that the boat is within acceptable weight limits.

Recommendation 36 — *Consider re-engineering the control switch on the crane/davit for obvious forward and reverse operation.* The current switch does not have an obvious transition from forward to reverse and can present a significant safety problem during operation.

Recommendation 37 — *Consider providing more hands-on launch and recovery operations training in nonemergency conditions.* This type of training provides crew members with better learning opportunities without the pressure of a critical situation.

Recommendation 38 — *Consider maintaining the consistency of the personnel on the launch and recovery team to improve crew coordination.* Personnel supporting this operation rotate duties frequently, and team inexperience presents safety and operational problems.

Recommendation 39 — *Consider installing a light on the weather deck that indicates whether the hydraulic pump is running.* If the hydraulic pump is not turned off after the operation, the pump may overheat and start a fire.

Recommendation 40 — *Consider establishing a consistent set of personnel on the boarding team to improve coordination between team members.* Personnel supporting this operation rotate duties frequently, and team inexperience presents safety and operational problems.

Recommendation 41 — *Consider including the coxswain in the boarding pre-brief to ensure that the coxswain is aware of the boarding plan.* Currently, the coxswain is not included in the boarding pre-brief and must be briefed by the boarding team (if briefed at all). Including the coxswain in the pre-brief will better prepare the coxswain for the operation and help to ensure a safer transit.

Recommendation 42 — *Consider having the coxswain get a bridge-eye view of the transit path and subject vessel before the boarding evolution.* A view of the transit path, sea conditions, and subject vessel can help ensure a safer transit and unloading of boarding team members to the subject vessel.

Recommendation 43 — *Consider providing the boarding team with brighter flashlights to improve night boarding visibility and visibility in dark vessel spaces (e.g., state-of-the-art lights).* Having the brightest possible lights can help ensure safer operations in the dark.

Recommendation 44 — *Consider rotating boarding team members during high temperature evolutions to reduce fatigue and heat exhaustion.* With all of the personal protective equipment required for boarding and the physical requirements of the operation, a rotation of team members can help ensure safe operations during extended boardings.

Recommendation 45 — *Consider ensuring that boarding teams carry plenty of water during high temperature operations.* Having plenty of water available during hot weather will help combat fatigue and heat exhaustion.

Recommendation 46 — *Consider having boarding teams carry hearing protection and use the protection when inspecting high noise areas on the subject vessels (e.g., engine room, compressor, or generator spaces).* Currently, boarding team members do not carry hearing protection and the subject vessels rarely have the protection available. Boarding team members should carry hearing protection and use the protection when in the presence of a suspected high noise source.

Recommendation 47 — *Consider requiring all boarding team members to be inoculated before performing boardings (e.g., hepatitis A and B, gamma globulin).* Boarding team members can be exposed to a variety of diseases and viruses during boardings. Members should receive a standard set of inoculations before their first boarding.

Recommendation 48 — *Consider implementing safety function (operational) checks of small arms weapons before each boarding.* This check will help ensure that the weapon will operate safely.

Recommendation 49 — *Consider having the boarding team collectively load and unload small caliber weapons.* Coordination of loading and unloading allows the gunner's mate and other safety supervisors to monitor this activity and helps ensure safety.

Recommendation 50 — *Consider using wireless communication equipment for the landing safety officer (LSO), pilot, helicopter control officer (HCO), and helicopter team to improve communications.* During helicopter operations, it is difficult to hear instructions when wearing the required hearing protection. Wireless communication equipment will improve the helicopter team's communication while allowing them freedom of movement.

Recommendation 51 — *Consider screening venders that have previously supplied contaminated/low quality fuel oil.* Contaminated/low quality fuel must be cleaned by the cutter before it can be used. Some vendors have consistently provided low quality fuel, and these vendors should be screened to reduce cost.

Recommendation 52 — *Consider improving eye and face protection when refueling the helicopter, such as adding a face shield to helmets.* Currently, only goggles are required to be worn when refueling the helicopter. The goggles will only protect the eyes (and not the rest of the face) if there is a fuel spill.

Recommendation 53 — *Consider changing the type of gloves worn by the fueling team to rubber gloves to protect the crew from the fuel oil.* The current cotton gloves absorb the fuel oil.

Recommendation 54 — *Consider ensuring that load tests are performed on chain falls and that preventive maintenance on the chain falls is working.* All chain falls in the repair lockers should be periodically weight tested to ensure safe operations.

Recommendation 55 — *Consider updating the supplies and materials required to be warehoused on the cutter to reflect the current cutter requirements.* Modifying the requirements can reduce the cramped conditions in ship storage spaces and will help ensure that supplies and materials are safely stored.

Recommendation 56 — *Consider coding all gauges and other equipment so "in" parameter and "out of" parameter readings or conditions can be identified quickly by watchstanders.* Coding gauges and equipment can improve the reaction time to upset conditions.

Recommendation 57 — *Consider eliminating watchstanders during the work day and placing the responsibility for checking equipment or spaces on vessel personnel working with the equipment or working in the spaces.* During the day, vessel personnel are working throughout the vessel. The watchstander duties could be spread among multiple vessel personnel.

Recommendation 58 — *Consider installing cameras to watch the exterior parts of the vessel to reduce the number of watchstanders currently required.* The cameras could be monitored from a single location such as the bridge, mess deck, etc.

Recommendation 59 — *Consider moving the breaker for each individual electrical panel closer to the location of the panel.* Currently, breakers are in the control room and panels are distributed across the vessel. Having a breaker at the panel will give the person working on the breaker better control over the breaker and will provide assurance that it remains off.

Recommendation 60 — *Consider using ground fault circuit interrupters (GFCI) on all power cords used on the exterior of the vessel.* This will reduce the chance of electrical shock during exterior maintenance (e.g., deck maintenance).

8. *BENEFIT OF IMPLEMENTING RECOMMENDATIONS*

The benefit of implementing recommendations is not in the scope of this analysis. Table B.1 and Table B.2 are included in the event these exercises are performed later. The method for performing these exercises is discussed in Reference 1.

9. *CONCLUDING REMARKS*

The analysis results establish a risk baseline for a majority of WMEC-210 operations/evolutions, and should be effective in supporting the needs of the Paragon project. Because the scope of this analysis did not cover all operations/evolutions of a WMEC-210, an additional analysis, if desired, should be performed and include the remaining WMEC-210 operations/evolutions.

10. REFERENCES

1. *Integrated Risk Assessment (IRA) User's Manual* (available from the Research and Development Center).

2. COMDINST M5100.47, *USCG Safety and Environmental Health Manual.*

ATTACHMENT A

Coarse Hazard Analysis Table for WMEC-210

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.1	Vessel/craft unavailable		SCREENED Mission impact - cannot perform the boarding Collision with another vessel							
Comments: This function considers small boat operations only										
1.2	Incorrect position/direction/ speed	Inexperienced coxswain (e.g., poor judgment) Sudden maneuvering of the other vessel causing the coxswain to take evasive action Position of the other vessel (may cause small boat to approach from a direction that would endanger small boat) Weather conditions (e.g., sudden change in conditions)	Capsizing vessel (small boat) Collision with another vessel Person overboard Hazardous exposure: contact injury	2	3	5	0.036	Medium	Personnel Qualification Standard (PQS) for coxswain Cutter gives guidance for safe transit During heavy seas and weather.the most experienced coxswain drives the small boat	41 42
Comments: This function considers small boat operations only										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.3	Vessel/craft fails to maintain position	Mechanical failure of engine/steering system Misjudging sea state (e.g., sea state pulls small boat away from vessel) Inexperienced coxswain (e.g., poor judgment)	Person overboard Hazardous exposure: contact injury Equipment damage/loss - small boat	2	3	5	0.036	Medium	Safety observers on bridge directing the operation Open communication between bridge, coxswain, and boarding team PQS for coxswain Personal protective equipment (PPE) - personal floatation device (PFD), steel-toed shoes Most experienced boarding team member boards the subject vessel first and helps others over	41 42

Comments: This function considers small boat operations only

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.4	Vessel struck by floating object		SCREENED							

Comments: This function considers small boat operations only

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.5	Vessel impacts submerged object		SCREENED							

Comments: This function considers small boat operations only

Table A.1 Coarse Hazard Analysis for WMEC-210

Boarding - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.6	Vessel struck by another vessel	Aggression from subject vessel Inattention of subject vessel (collides with small boat) Weather and sea conditions (e.g., wind blows a sail boat into vessel)	SCREENED Equipment damage/loss Person overboard Collision with another vessel Hazardous exposure: contact injury						PQS of coxswain (trained to watch subject vessel and remain at appropriate distance)	
Comments: This function considers small boat operations only										
1.7	Physical hazards exposure	Slippery decks (e.g., water, oil, fish, ice) Loose gear in small boat and subject vessel Poor quality Jacobs ladders on subject vessel Dangerous egress Poor quality lifelines on subject vessel Weather/sea conditions	Person overboard Hazardous exposure: contact injury	3	4	6	0.36		PPE - PFD, safety shoes Most experienced boarding team member boards the subject vessel first and helps others over	40 43
Comments: This function considers small boat operations only										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.8	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments: This function considers small boat operations only										
1.9	Fire/explosion		SCREENED							
Comments: This function considers small boat operations only										
1.10	Asphyxiant environment exposure		SCREENED							
Comments: This function considers small boat operations only										
1.11	Electrical hazards exposure		SCREENED							
Comments: This function considers small boat operations only										
1.12	High pressure materials exposure		SCREENED							
Comments: This function considers small boat operations only										
1.13	High noise exposure		SCREENED							
Comments: New motor surf boat (MSB) is significantly quieter This function considers small boat operations only										
1.14	Excessive vibration exposure		SCREENED							
Comments: This function considers small boat operations only										

Table A.1 Coarse Hazard Analysis for WMEC-210

Boarding - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.15	Radiation exposure		SCREENED							
Comments: This function considers small boat operations only										
1.16	Biological hazards exposure		SCREENED							
Comments: This function considers small boat operations only										
1.17	Hot/cold environments exposure	Water exposure Sun/heat (e.g., sunburn, fatigue)	Hazardous exposure: hot/cold environment - hypo/hyperthermia	1	2	6	0.3006		Exposure time is limited Boarding team leader and members watch for exposure problems Water is taken with boarding team on hot days Sunscreen	44 45
Comments: This function considers small boat operations only										
1.18	Hot/cold surfaces/materials exposure		SCREENED							
Comments: This function considers small boat operations only										

Table A.1 Coarse Hazard Analysis for WMEC-210

Boarding - Small caliber weapons and other weapons

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
2.1	Inoperable weapons		SCREENED						Weapons are well maintained	48
Comments:										
2.2	Inadvertent firing	Personnel error (e.g., inattention, not following procedures during loading/clearing weapon)	Hazardous exposure: contact injury Equipment damage/loss	2	3	4	0.009	Medium	Three safety functions on 9mm weapon Gunner's mate issues and retrieves weapon and supervises weapons loading/unloading Training for handling weapons Weapons clearing/loading procedure (the procedure is not performed collectively) PQS for boarding team members Procedure for holstering weapon Safe weapon design (will not fire if dropped)	48 49
Comments:										
2.3	Inadvertent actuation of nonfirearm weapon		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Boarding - Small caliber weapons and other weapons

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
2.4	Firing live ammunition instead of blanks		SCREENED							
Comments:										
2.5	Firing at the wrong target/position		SCREENED							
Comments:										
2.6	Physical hazards exposure		SCREENED							
Comments:										
2.7	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
2.8	Fire/explosion		SCREENED							
Comments:										
2.9	Asphyxiant environment exposure		SCREENED							
Comments:										
2.10	Electrical hazards exposure		SCREENED							
Comments:										
2.11	High pressure materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Boarding - Small caliber weapons and other weapons

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
2.12	High noise exposure		SCREENED							
Comments:										
2.13	Excessive vibration exposure		SCREENED							
Comments:										
2.14	Radiation exposure		SCREENED							
Comments:										
2.15	Biological hazards exposure		SCREENED							
Comments:										
2.16	Hot/cold environments exposure		SCREENED							
Comments:										
2.17	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Boarding - Providing assessment/investigation/coordination services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
3.1	Inadequate/no assessment/ investigation/ coordination		SCREENED							
Comments:										
3.2	Assessment/ investigation/ coordination quality problem	Inexperience of inspector Poor quality equipment (e.g., flashlight not adequate) Inspector is in a hurry and fails to recognize hazards Inspector fails to communicate hazards to the boarding team	Hazardous exposure: contact injury Hazardous exposure: electrical shock Hazardous exposure: toxic/corrosive materials Hazardous exposure: asphyxiants	1	3	5	0.0333	Medium	Initial safety inspection training Subject vessel's crew is mustered to ensure all crew is accounted for PQS for boarding team members	40 43
Comments: Initial safety inspection was the issue of concern										

Table A.1 Coarse Hazard Analysis for WMEC-210

Boarding - Providing assessment/investigation/coordination services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
3.3	Physical hazards exposure	Poor quality ladder systems on subject vessel	Hazardous exposure: contact injury	2	3	7	3.006	High	Boarding team members communicate hazards to the other team members as they identify them	40
		Tight quarters and low overheads on subject vessel								43
		Poor quality lifelines on subject vessel							Subject vessel personnel are assembled for accountability	
		Shifting cargo on subject vessel							PPE - safety shoes (PFDs are removed when on board)	
		Tripping on gear (e.g., fishing tackle, nets, ropes, equipment) on subject vessel							PQS for boarding team	
		Aggressive people on subject vessel								
Comments:										
3.4	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
3.5	Fire/explosion	Excessive fuel in bilge	SCREENED							
		Poor maintenance in engine room								
		Poor electrical wiring	Hazardous exposure: contact injury							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Boarding - Providing assessment/investigation/coordination services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
3.6	Asphyxiant environment exposure	Exposure to ammonia releases on fishing vessels	Hazardous exposure: toxic/corrosive materials	2	3	5	0.036	Medium	Significant training on confined space entry and toxic/corrosive hazards	40
Comments:										
3.7	Electrical hazards exposure		SCREENED							
Comments:										
3.8	High pressure materials exposure		SCREENED							
Comments:										
3.9	High noise exposure	Engine rooms of subject vessel Generators on subject vessel Compressors on subject vessel	SCREENED Hazardous exposure: noise exposure							46
Comments:										
3.10	Excessive vibration exposure		SCREENED							
Comments:										
3.11	Radiation exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Boarding - Providing assessment/investigation/coordination services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
3.12	Biological hazards exposure	Lack of sanitation on subject vessel Poor or no septic system on subject vessel Personnel on subject vessel carrying disease (e.g., hepatitis, tuberculosis, AIDS)	Hazardous exposure: biological (e.g., human waste, hepatitis)	4	3	3	0.3033	Medium	PPE - plastic gloves Decontamination station set up on cutter Vaccinations for appropriate diseases	47
Comments:										
3.13	Hot/cold environments exposure		SCREENED							
Comments: Risk captured under Operating vessel/craft - Hot/cold environment exposure										
3.14	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - fire - Providing fire services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.1	Inadequate/no fire services		SCREENED							
Comments:										
4.2	Fire service quality problem		Providing damage control functions and addressed as safeguards in other deviations [listed as "Damage control (fire) capability"]							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.3	Physical hazards exposure	Movement to/from scene (ladders, watertight doors, people rushing to scene) Personnel tugging on/giving too much slack in hose Too many hoses in a cramped compartment causing tripping Personnel not latching watertight doors open Personnel dropping into an open scuttle Carrying cumbersome or too much gear to a scene Failed hose nozzle resulting in uncontrolled water spray Slip/trip/fall due to decreased visibility Poor planning of damage control fire drill	Hazardous exposure: contact injury Equipment damage/loss	2	5	6	0.603	High	Damage control shipboard fire training, making training as realistic as possible (training in the Cutter Training Manual) On-scene team leader manages the situation and supervises personnel (near fire) Attack team leader supervising immediate flood scene Schools - basic firefighting, advanced firefighting, helicopter firefighting, damage control repair locker leader Weekly damage control training for vessel personnel Navy publications for firefighting - NSTM 555 (Navy Fire Fighting Doctrine) Main Space Fire Fighting Doctrine - Use template WMEC-210 doctrine and tailor to vessel needs Damage control qualification for Watch Quarter and Station Bill Zone alarms alert to the	7 8 9 10 11 13 14 17 20 21

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - fire - Providing fire services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									location (deck/frame) of fires	
									Damage control (DC) management using damage control plot	
									Drills are planned, briefed, and critiqued	
									Safety walkthroughs before drills	
									DC drills monitored by Damage Control Training Team (DCTT), which can stop a drill at any time	
									Additional safety precautions for drills, such as only one person on a ladder at any time	
									DC drills during Tailored Ship Availability Training (TSTA)	
									Preventive maintenance on DC equipment	

Comments: The hazards associated with training for DC fire events are also included in this deviation
Class C and Class D mishaps are driven by DC fire training
DC fire drills occur twice per week while underway. More drills are conducted when preparing for refresher training (AEFTRA). About 75 to 100 DC fire drills are conducted per year
Equipment damage concern: Thermal imager (drives Class C losses), O2 indicators (drives Class D losses), radio losses
General emergency - two DC teams: Repair 2 has 25 people (forward part of the ship) and Repair 3 has 20 people (aft part of the ship). DC Central is the ship's log office, where the damage control assistant (DCA) mans the station
St. Petersburg fire department will come to the vessel for external assistance, but will not enter the vessel

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.4	Toxic/corrosive/ reactive materials exposure	Fire in a paint locker Carbon monoxide and carbon dioxide from combustibles Fire burning hull insulation (toxic and asphyxiants) Burning electrical insulation (toxic and asphyxiants) Burning mooring lines (polypropylene) Battery acid exposure when fire ruptures batteries Benzene contact/intake in spilled fuel oil while responding to fire Diesel engine corrosion inhibitor contact/intake after container ruptures in a fire Personnel running out of air from oxygen breathing apparatus (OBA) Personnel entering compartments with no OBA canisters Attack team leader/on-scene leader not maintaining fire boundary and flooding adjacent compartments with toxic or other substances	Hazardous exposure: toxic/corrosive materials Hazardous exposure: asphyxiants	2	4	4	0.036	Medium	Toxic/corrosive hazards are identified and listed per compartment (for damage control purposes) Hazard communication (HAZCOM) program for identifying and handling hazardous materials Use of air sampling equipment Effective use of ship's firefighting equipment, lowering exposure to personnel (portable equipment, fixed systems - engine room, galley, armory) Preventive maintenance on firefighting equipment to ensure that it operates properly (equipment inspections, hydro tests on pressurized containers, fire boundary inspections, flush fire water system, fire pump tests) Damage control shipboard fire training as realistic as possible (Cutter Training Manual) On-scene team leader manages the situation and supervises personnel (near	7 8 9 10 11 12 13 17 18 19

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									fire)	
									Attack team leader supervising immediate fire scene	
									Schools - basic firefighting, advanced firefighting, helicopter firefighting, repair locker leader	
									Weekly damage control training for vessel personnel	
									Navy publications for firefighting - NSTM 555 (Navy Fire Fighting Doctrine)	
									Main Space Fire Fighting Doctrine - Use template WMEC-210 doctrine and tailor to vessel needs	
									Damage control qualification for Watch Quarter and Station Bill	
									Zone alarms alert to the location (deck/frame) of fires	

Comments: Includes chemical exposures and asphyxiant exposures
Toxic inhalation and smoke inhalation are large concern
Ventilating compartments or fighting fire may expose personnel other than DC party

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.5	Fire/explosion	Personnel fighting fire with no/inadequate firefighting gear (PPE) Personnel stay too long in a compartment and become heat stressed Personnel take an improper route to fire and expose themselves to hot surfaces/environments Improperly following Main Space Fire Fighting Doctrine Inadvertently spraying personnel so that they become exposed to heat/steam while fighting fire Boundary personnel not maintaining fire boundaries properly DCA improperly manages fire and sends personnel into fire prematurely or causes fire to spread Repair leader/on-scene leader sends personnel into fire prematurely or causes fire to spread Personnel shed protective equipment while in fire environment Personnel entering tight	Fire/explosion Hazardous exposure: hot environment/surface/material Equipment damage/loss	2	4	4	0.036	Medium	DCA managing fire from DC Central Effective use of ship's firefighting equipment, lowering exposure to personnel (portable equipment, fixed systems - engine room, galley, armory) Ship's helicopter fire team can attack a fire quickly with aqueous film forming foam (AFFF) Preventive maintenance on firefighting equipment to ensure that it operates properly (equipment inspections, hydro tests on pressurized containers, fire boundary inspections, flush fire water system, fire pump tests) Damage control shipboard fire training as realistic as possible (Cutter Training Manual) On scene team leader manages the situation and supervises personnel (near fire) Attack team leader supervising immediate fire scene	7 8 9 10 11 12 13 14 17

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - fire - Providing fire services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
		spaces/areas (paint locker) and struggle once inside								
		Personnel overzealously attack a fire and cause equipment damage							Schools - basic firefighting, advanced firefighting, helicopter firefighting, repair locker leader	
									Weekly damage control training for vessel personnel	
									Navy publications for firefighting - NSTM 555 (Navy Fire Fighting Doctrine)	
									Main Space Fire Fighting Doctrine - Use template WMEC-210 doctrine and tailor to vessel needs	
									Damage control qualification for Watch Quarter and Station Bill	
									Zone alarms alert to the location (deck/frame) of fires	
									Damage Control Petty Officer (DCPO) school and qualification standard	

Comments: Includes causing/expanding fires, hot environments exposure, and hot surfaces exposure
Two AFFF hoses available for helicopter fires
Most fires are small and contained. Equipment damage mostly dominates losses (rather than personnel losses)

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.6	Asphyxiant environment exposure		See toxic/corrosive/reactive materials exposure							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.7	Electrical hazards exposure	Not securing power to casualty area	Hazardous exposure: electrical shock	2	3	3	0.0063	Low	DCA managing fire from DC Central	7
		Touching CO2 nozzle on energized equipment	Equipment damage/loss						Ship's firefighting equipment lowering exposure to personnel (portable equipment, fixed systems - engine room, galley, armory)	9
		Improperly rigging casualty power cables							Preventive maintenance on firefighting equipment to ensure that it operates properly (equipment inspections, hydro tests on pressurized containers, fire boundary inspections, flush fire water system, fire pump tests)	11
		Improper extinguishing agent (water on electrical fire)							DC shipboard fire training as realistic as possible (Cutter Training Manual)	12
		Personnel not wearing proper PPE							On-scene team leader to manage local fire and supervise personnel (near fire)	13
									Attack team leader supervising direct fire scene	17
									Schools - basic firefighting, advanced firefighting, helicopter firefighting, repair locker leader	
									Navy publications - NSTM 555 (Navy Fire Fighting Doctrine)	

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - fire - Providing fire services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									Main Space Fire Fighting Doctrine - Use template WMEC-210 doctrine and tailor to vessel needs	
									DC qualification for Watch Quarter and Station Bill	
									DCPO school and qualification standard	
									Checklists for securing electrical power	
									Preventive maintenance on electrical PPE	
									Emergency response kit with electrical tools/equipment	
									Inventory of repair locker to ensure all items are present	
									Weekly damage control training for vessel personnel	
									Zone alarms alert to the location (deck/frame) of fires	

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.8	High pressure materials exposure		SCREENED - Limited quantities, and most high pressure materials are stored on exterior of vessel. Hydraulics are not all located in engine room, have pressure relief, and are secured in a fire							
Comments:										
4.9	High noise exposure		SCREENED							
Comments:										
4.10	Excessive vibration exposure		SCREENED							
Comments:										
4.11	Radiation exposure		SCREENED							
Comments:										
4.12	Biological hazards exposure		SCREENED							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.13	Hot/cold environments exposure	Personnel exposed to engine room environment, either in firefighting PPE or not in PPE (ensemble) Personnel experiencing heat stress/heat stroke while topside (helicopter drills) Personnel experience heat stress/heat stroke while in firefighting PPE (ensemble)	See Fire/Explosion Hazardous exposure; hot environment/surface/material						Damage control drills are planned, briefed, and critiqued Corpsman provides annual heat stress training Corpsman on DCTT for planning purposes On-scene team leader to manage local fire and supervise personnel (near fire) Schools - basic firefighting, advanced firefighting, helicopter firefighting, repair locker leader Attack team leader supervising direct fire scene DC qualification for Watch Quarter and Station Bill DC drills monitored by DCTT, which can stop a drill at any time	

Comments: The hazards associated with training for DC fire events are also included in this deviation

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.14	Hot/cold surfaces/materials exposure		See Fire/Explosion							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - flood - Providing flood control services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.1	Inadequate/no flood control		Damage control functions are addressed as safeguards in other deviations							
Comments:										
5.2	Flood control quality problem		Damage control functions are addressed as safeguards in other deviations [listed as "Damage control (flooding) capability"]							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - flood - Providing flood control services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.3	Physical hazards exposure	Movement to/from scene (ladders, watertight doors, people rushing to scene)	Hazardous exposure: contact injury	2	5	5	0.333	High	Additional safety precautions for drills, such as only one person on a ladder at any time	7
										9
		Personnel dropping into an open scuttle	Drowning						DC drills monitored by DCTT, which can stop a drill at any time	13
										16
		Carrying cumbersome gear/shoring or too much gear/shoring to a scene							Safety walkthroughs before drills	17
		Tripping over hoses rigged to scene for dewatering							Drills are planned, briefed, and critiqued	
		Physical impact from hammers							Damage control shipboard flooding training, making training as realistic as possible (training in the Cutter Training Manual)	
		Cut on damage control equipment								
		Too many hoses in a cramped compartment, causing tripping							On-scene team leader manages the situation and supervises personnel (near flood)	
									Attack team leader supervising immediate flood scene	
									Schools - repair locker leader, basic damage control, DCA school	
									Damage control qualification for Watch Quarter and Station Bill	
									PPE - rubber boots, helmets,	

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - flood - Providing flood control services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									long-sleeve flash jerseys, gloves	
									Weekly damage control training for vessel personnel	
									Damage control drills during TSTA	
									Preventive maintenance on damage control equipment - clean/lubricate pumps/jets, inventory damage control kits/repair lockers	
									Damage control management using damage control plot	

Comments: The hazards associated with training for DC flood events are also included in this deviation
Class D mishaps not as frequent as training for fire drills because (1) personnel are not wearing firefighting ensembles (heat stress) and (2) thermal imager equipment is not used

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.4	Toxic/corrosive/ reactive materials exposure		SCREENED							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.5	Fire/explosion		SCREENED							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.6	Asphyxiant environment exposure		SCREENED							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.7	Electrical hazards exposure	Water spray/flooding on electrical panels near damage control personnel (personnel may be too focused on flooding instead of electrical panels) On-scene leader prematurely directs damage control electrician to secure a source or wrong source Electrical securing list in error and wrong source secured - personnel shocked by source still energized Defective electrical submersible pump Incorrect handling/hookup of casualty power cables Improper/defective electrical PPE	Hazardous exposure: electrical shock Equipment damage/loss	2	3	4	0.009	Medium	Damage control shipboard flooding training, making training as realistic as possible (training in the Cutter Training Manual) On-scene team leader manages the situation and supervises personnel (near flood) Attack team leader supervising immediate flood scene Schools - repair locker leader, basic damage control, DCA school Damage control qualification for Watch Quarter and Station Bill Weekly damage control training for vessel personnel Damage control drills during TSTA Use electrical securing lists, which show circuits feeding loads Electricians use system knowledge to correct wrong orders Damage control management	7 9 13 16 17 26

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - flood - Providing flood control services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									using damage control plot Electrical preventive maintenance on damage control equipment/PPE - electrical safety check, operational tests on pumps, megger checks on pumps	
Comments:										
5.8	High pressure materials exposure		SCREENED							
Comments:										
5.9	High noise exposure		SCREENED							
Comments:										
5.10	Excessive vibration exposure		SCREENED							
Comments:										
5.11	Radiation exposure		SCREENED							
Comments:										
5.12	Biological hazards exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - flood - Providing flood control services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.13	Hot/cold environments exposure	Personnel fighting flooding with no/inadequate PPE gear Personnel stay too long in a compartment and become hypothermic Mismanagement of personnel exposure by DCA, on-scene leader, or attack leader	Hazardous exposure: cold environment/surface/material	2	3	4	0.009	Low	Damage control shipboard flooding training, making training as realistic as possible (training in the Cutter Training Manual) On-scene team leader manages the situation and supervises personnel (near flood) Attack team leader supervising immediate flood scene Schools - repair locker leader, basic damage control, DCA school Damage control qualification for Watch Quarter and Station Bill Weekly damage control training for vessel personnel Damage control management using damage control plot Using PPE (especially mustangs in northern waters) Preventive maintenance on survival gear and mustang suits	9 16 17

Comments: Team has more experience with warmer water operations than colder water operations

Table A.1 Coarse Hazard Analysis for WMEC-210

Damage control - flood - Providing flood control services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.14	Hot/cold surfaces/materials exposure		SCREENED							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
6.1	Vessel/craft unavailable		SCREENED							
Comments:										
6.2	Incorrect position/direction/ speed		SCREENED							
Comments: Do not have to operate under rough conditions like cutters in the north Atlantic/Pacific. Southern vessel operations can be more selective (especially when conducting operators in heavy weather) and thus protect helicopter										

Helicopter operations - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
6.3	Vessel/craft fails to maintain position	Weather/sea conditions Failure of communication between Landing Safety Officer (LSO) and pilot Failure of communication between Helicopter Control Officer (HCO) and LSO Mechanical failure of cutter's engine or steering system	Hazardous exposure: contact injury Person overboard Equipment damage/loss - collision with helicopter	2	3	4	0.009	Medium	PQS for helicopter watch stations Standardization of procedures and signals Helicopter team training Coast Guard ship helicopter manual LSO can wave off helicopter at any point in the operation Review of the safeguards (ensuring the safeguards are in place and working) Air operations manual Aviation certification for helicopter crew Safety supervisors (LSO and HCO) Multiple personnel on the bridge to detect maneuvering errors Ships standing orders during operations Preventive maintenance of engines and steering system	

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
6.4	Vessel struck by floating object		SCREENED							
Comments:										
6.5	Vessel impacts submerged object		SCREENED							
Comments:										
6.6	Vessel struck by another vessel		SCREENED							
Comments:										
6.7	Physical hazards exposure		SCREENED							
Comments:										
6.8	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
6.9	Fire/explosion		SCREENED							
Comments:										
6.10	Asphyxiant environment exposure		SCREENED							
Comments:										
6.11	Electrical hazards exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
6.12	High pressure materials exposure		SCREENED							
Comments:										
6.13	High noise exposure		SCREENED							
Comments:										
6.14	Excessive vibration exposure		SCREENED							
Comments:										
6.15	Radiation exposure		SCREENED							
Comments:										
6.16	Biological hazards exposure		SCREENED							
Comments:										
6.17	Hot/cold environments exposure		SCREENED							
Comments:										
6.18	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Operating aircraft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
7.1	Aircraft unavailable	Mechanical failure of helicopter Weather/sea conditions Lack of spare parts for the helicopter in inventory Pilot fatigue	Hazardous exposure: cold environment - person in the water for a long time Drowning - person in the water during search and rescue (SAR) Mission impact - unable to perform SAR or Law Enforcement	3	5	6	0.63	Medium	Air operations instructions Preventive maintenance on the helicopter (engine, rotor) Other helicopters available at shore facilities Training of pilots Small boats can be deployed for search and rescue Aviation certification for helicopter crew	

Comments: Assessed as mission impact (unable to deploy helicopter during critical mission) as well as safety (unable to retrieve person in the water)

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Operating aircraft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
7.2	Incorrect position/direction/ speed	Pilot inexperience Poor judgment of pilot or helicopter team Weather/sea conditions Misinterpretation of LSO signals Poor communications between pilot and helicopter team Poor helicopter team coordination	Equipment damage/loss - collision with cutter, loss of helicopter Fire/explosion Person overboard Hazardous exposure: contact injury	2	2	2	0.00333	Medium	PQS for helicopter watch stations Aviation certification for pilots Standardization of procedures and signals Helicopter team training Coast Guard ship helicopter manual LSO can wave off helicopter at any point in the operation Review of the safeguards (ensuring the safeguards are in place and working) Air operations manual Aviation certification for helicopter crew Damage control (fire) capability	

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
7.3	Aircraft fails to maintain position	Pilot inexperience Poor judgment of pilot or helicopter team Weather/sea conditions Misinterpretation of LSO signals Poor communications between pilot and helicopter team Poor helicopter team coordination	Fire/explosion Equipment damage/loss - collision with cutter, loss of helicopter Hazardous exposure: contact injury Person overboard	2	3	3	0.0063	High	PQS for helicopter watch stations Standardization of procedures and signals Helicopter team training Coast Guard ship helicopter manual LSO can wave off helicopter at any point in the operation Review of the safeguards (ensuring the safeguards are in place and working) Air operations manual Aviation certification for helicopter crew Aviation certification for pilots Damage control (fire) capability	

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
7.4	Physical hazards exposure	Poor judgment of helicopter team Weather/sea conditions Misinterpretation of LSO signals Poor helicopter team coordination Fatigue of helicopter team members Poor communications between pilot and helicopter team Pilot inexperience	Hazardous exposure: contact injury - rotor blades, struck by load, etc. Person overboard	2	3	3	0.0063	Medium	Foreign object debris walk down PQS for helicopter watch stations Aviation certification for pilots Standardization of procedures and signals Helicopter team training Coast Guard ship helicopter manual LSO can wave off helicopter at any point in the operation Review of the safeguards (ensuring the safeguards are in place and working) Air operations manual Aviation certification for helicopter crew	30

Comments:

No.	Deviation		Potential Mishap Types
7.5	Toxic/corrosive/ reactive materials exposure		SCREENED

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Operating aircraft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
7.6	Fire/explosion		SCREENED							
Comments:										
7.7	Asphyxiant environment exposure		SCREENED							
Comments:										
7.8	Electrical hazards exposure	Static discharge from helicopter Improper grounding of helicopter Poor metal-to-metal contact when using the static discharge wand Fatigue of helicopter team members	Hazard exposure: electrical shock Person overboard Equipment damage/loss	2	2	4	0.0063	Medium	PQS for helicopter watch stations Standardization of procedures and signals Helicopter team training Coast Guard ship helicopter manual Review of the safeguards (ensuring the safeguards are in place and working) Air operations manual Aviation certification for helicopter crew	30
Comments:										
7.9	High pressure materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Operating aircraft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
7.10	High noise exposure	Helicopter engine Hearing protection and high noise reduces the ability to hear instructions	Hazardous exposure: noise Hazardous exposure: contact injury Equipment damage/loss Person overboard	2	4	5	0.063	Medium	Helicopter team uses hand signals Hearing protection	50

Comments: This deviation considers both damage to hearing due to high noise exposure, and inability to safely and effectively perform the mission or being injured due to not being able to communicate because of the high noise and wearing hearing protection

No.	Deviation	Potential Mishap Types
7.11	Excessive vibration exposure	SCREENED

Comments:

No.	Deviation	Potential Mishap Types
7.12	Radiation exposure	SCREENED

Comments:

No.	Deviation	Potential Mishap Types
7.13	Biological hazards exposure	SCREENED

Comments:

No.	Deviation	Potential Mishap Types
7.14	Hot/cold environments exposure	SCREENED

Comments:

No.	Deviation	Potential Mishap Types
7.15	Hot/cold surfaces/materials exposure	SCREENED

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
8.1	Inadequate/no electrical power service		SCREENED							
Comments:										
8.2	Incorrect electrical power frequency/ voltage/phase	Failure of hot start equipment Inexperience of helicopter team operating equipment	Equipment damage to/loss of helicopter Hazardous exposure; electrical shock	2	2	3	0.0036	Low	Preventive maintenance of hot start equipment	29
Comments: This deviation captured the improper use of the equipment										
8.3	Physical hazards exposure		SCREENED							
Comments:										
8.4	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
8.5	Fire/explosion		SCREENED							
Comments:										
8.6	Asphyxiant environment exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Providing electrical power services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
8.7	Electrical hazards exposure	Failure of hot start or static grounding equipment	Hazardous exposure: electrical shock	2	2	3	0.0036	Low	Preventive maintenance of hot start equipment	29
		Inexperience of helicopter team operating equipment	Equipment damage/loss - hot start equipment							
Comments:										
8.8	High pressure materials exposure		SCREENED							
Comments:										
8.9	High noise exposure		SCREENED							
Comments:										
8.10	Excessive vibration exposure		SCREENED							
Comments:										
8.11	Radiation exposure		SCREENED							
Comments:										
8.12	Biological hazards exposure		SCREENED							
Comments:										
8.13	Hot/cold environments exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Providing electrical power services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
8.14	Hot/cold surfaces/materials exposure		SCREENED							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Providing fueling services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
9.1	Inadequate/no fueling service	Mechanical failure of pumps, valves, and/or hoses Valves misaligned Weather/sea conditions Out of fuel	Equipment damage/loss Drowning Hazardous exposure: cold exposure Unable to perform a SAR	2	2	2	0.00333	Medium	Daily soundings of fuel tanks performed Spare hoses Helicopter team training Standardization of procedures and signals Coast Guard ship helicopter manual	
Comments:										
9.2	Fuel quality problem	Low quality fuel received from vendor Inexperienced personnel testing fuel Failure of fuel test equipment	Equipment damage/loss - loss of helicopter Drowning - during SAR Economic loss - replacing bad fuel or straining fuel	3	4	5	0.09	Medium	Fuel test Preventive maintenance on fuel test equipment Fuel standards PQS for fueling personnel	51
Comments:										
9.3	Physical hazards exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Providing fueling services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
9.4	Toxic/corrosive/ reactive materials exposure	Failure of equipment (e.g., fitting, hose, pump), resulting in a spill of fuel	Hazardous exposure: toxic/corrosive materials	2	3	5	0.036	High	Training of LSO, refueling party, helicopter crew, and pump room	52
										53
		Inexperienced fueling personnel							Preventive maintenance on fueling equipment	
		Lack of communication between LSO, refueling party, helicopter crew, and pump room							PPE - goggles, gloves, hard hat	
									Standardization of procedures for performing fueling operations	
									Air operations manual	

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
9.5	Fire/explosion	Ruptured fuel hose	Fire/explosion	2	2	2	0.00333	Medium	Damage control (fire) capability	
		Helicopter exhaust	Equipment damage/loss						Standardization of fueling procedures	
									Fueling team training	
									Fueling team backs up the fire party	
									High flash point fuel	
									Preventive maintenance on fueling equipment	

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
9.6	Asphyxiant environment exposure		SCREENED							
Comments:										
9.7	Electrical hazards exposure		SCREENED							
Comments:										
9.8	High pressure materials exposure		SCREENED							
Comments:										
9.9	High noise exposure		SCREENED							
Comments:										
9.10	Excessive vibration exposure		SCREENED							
Comments:										
9.11	Radiation exposure		SCREENED							
Comments:										
9.12	Biological hazards exposure		SCREENED							
Comments:										
9.13	Hot/cold environments exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Helicopter operations - Providing fueling services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
9.14	Hot/cold surfaces/materials exposure		SCREENED							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.1	Vessel/craft unavailable		SCREENED							
Comments:										
10.2	Incorrect position/direction/ speed	Weather/sea conditions Failure to appreciate challenges to coxswain (assuming coxswain is experienced enough to handle conditions) Poor/lack of communication between cutter, coxswain, and small boat launch/recovery team Mechanical failure of cutter's engine or steering system	Equipment damage/loss - cutter, small boat, and lifting equipment Hazardous exposure: contact injury	4	4	5	0.36	Medium	Training for operating vessel during small boat operations Ships standing orders during operations Briefing before operation, discussing launch/recovery plan Multiple personnel on the bridge to detect maneuvering errors Preventive maintenance of engines and steering system	38 41
Comments:										
10.3	Vessel/craft fails to maintain position		SCREENED							
Comments:										
10.4	Vessel struck by floating object		SCREENED							
Comments:										
10.5	Vessel impacts submerged object		SCREENED							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.6	Vessel struck by another vessel		SCREENED							
Comments:										
10.7	Physical hazards exposure		SCREENED							
Comments:										
10.8	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
10.9	Fire/explosion		SCREENED							
Comments:										
10.10	Asphyxiant environment exposure		SCREENED							
Comments:										
10.11	Electrical hazards exposure		SCREENED							
Comments:										
10.12	High pressure materials exposure		SCREENED							
Comments:										
10.13	High noise exposure		SCREENED							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.14	Excessive vibration exposure		SCREENED							
Comments:										
10.15	Radiation exposure		SCREENED							
Comments:										
10.16	Biological hazards exposure		SCREENED							
Comments:										
10.17	Hot/cold environments exposure		SCREENED							
Comments:										
10.18	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
11.1	Lifting equipment unavailable	Failure of electrical system (e.g., short or opening in the switch, loss of power) Failure of hydraulic system Fouled cable (e.g., birds nest) Operator error	Equipment damage/loss - to small boat due to wave action, to cutter (cutter cannot maneuver) Hazardous exposure: contact injury - personnel injured due to sea swells Person overboard Mission impact - loss of personnel who need to be rescued, inability to perform a boarding, delays in helicopter/migrant operations	2	4	6	0.333		Preventive maintenance (cable inspections, hydraulic system, load test once a year, weight test, cutout tests quarterly) Capability to manually lower and raise MSB and rigid hull inflatable (RHI) boat Other small boat is available as a backup	31 32

Comments: Mishap Class D is a 6 for mission, 5 for safety

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
11.2	Loss of support	Overloading the small boat Mechanical failure of the davit/crane system Failure of lifting eyes on small boat Improper connection of the cables at the lifting point Misoperation of the lifting/lowering system Loss of power	Equipment damage/loss - small boat, cutter damage from small boat striking cutter Hazardous exposure: contact injury Person overboard	2	4	3	0.0333	Medium	Cables are over designed for the load Cables are weight tested yearly Preventive maintenance on cables, fittings, hooks, davit/crane system System is designed to hold position under loss of power PQS of lifting/lowering personnel	31 33 34 35

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Small boat launch/recovery - Operating lifting equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
11.3	Incorrect load position/direction/ speed	Personnel error (e.g., inattention, inexperience, not following procedure) Poor switch design (difficult to determine if the switch is in the forward or reverse direction)	Equipment damage/loss - small boat or cutter (from small boat hitting cutter) Hazardous exposure: contact injury	1	3	5	0.0333	Medium	Procedure for lifting/lowering boat Safety observer on bridge Safety observer on boat deck Person in charge of boat operation (watching for safety)	36 37
Comments:										
11.4	Physical hazards exposure	Personnel error (e.g., inattention, inexperience, not following procedure) Fatigue of the launch/recovery team Inconsistent deck crews (new personnel constantly rotating in and out of positions) Setting pins in ram Placing boats in cradles and installing pins (e.g., personnel being caught between cradle and boat) Falls or bail striking personnel Frapping lines in rough weather	Hazardous exposure: contact injury Person overboard	4	5	6	0.9	Medium	Open communication during each step of the operation Launch and recovery operations training Standard signals for operations Safety observer on bridge Safety observer on boat deck Person in charge of boat operation (watching for safety)	37 38
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Small boat launch/recovery - Operating lifting equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
11.5	Toxic/corrosive/ reactive materials exposure	Hydraulic system failure (e.g., lines part, fittings fail)	Hazardous exposure: toxic/corrosive materials	2	2	2	0.00333	Medium	Preventive maintenance on hoses and fittings (checking for wear and age) Hoses are rated for more pressure than required in the operation PPE - face shield (only when testing system)	
Comments:										
11.6	Fire/explosion	Hydraulic pump running after evolution is complete	Equipment damage/loss - failure of pump, leading to fire on cutter Fire/explosion	2	3	3	0.0063	Medium	Damage control (fire) capability	39
Comments:										
11.7	Asphyxiant environment exposure		SCREENED							
Comments:										
11.8	Electrical hazards exposure		SCREENED							
Comments:										
11.9	High pressure materials exposure		SCREENED							
Comments:										
11.10	High noise exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Small boat launch/recovery - Operating lifting equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
11.11	Excessive vibration exposure		SCREENED							
Comments:										
11.12	Radiation exposure		SCREENED							
Comments:										
11.13	Biological hazards exposure	Pumping collection and holding tank overboard into small boat	SCREENED							
Comments:										
11.14	Hot/cold environments exposure	Extended exposure to weather Type and amount of PPE worn for the evolution Personnel fatigue	Hazardous exposure: hot/cold environment - heat stroke, heat exhaustion, hypothermia	1	4	5	0.0603	Medium	Exposure time is limited in extreme conditions Supervisors trained to recognize heat/cold exposure problems	
Comments:										
11.15	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Anchored/moored/stored - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
12.1	Vessel/craft unavailable		Not evaluated							
Comments:										
12.2	Incorrect position/direction/ speed		Not applicable							
Comments: Duty section normally 10 people. Involves Officer of the Deck, Junior Officer of the Deck, and Engineer of the Watch										

Table A.1 Coarse Hazard Analysis for WMEC-210

Anchored/moored/stored - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
12.3	Vessel/craft fails to maintain position	Weather/sea conditions Pier cleats come loose Altering vessel position to support maintenance (e.g., for hull painting) Large tidal range that strains and parts mooring lines	SCREENED Collision with a fixed object Collision with another vessel Grounding						Lines normally doubled up in port Triple up lines if impending bad weather (use Heavy Weather Bill) Periodic rounds by Officer of the Deck (OOD), Boatswain's Mate of the Watch (BMOW) to check local vessel traffic and mooring line integrity (Commanding Officer's standing orders and guidance from Cutter Organization Manual) Use information from navigation brief (entering port brief) to estimate tidal range, times of tides, and currents while in port OOD watches weather reports (Commanding Officer's Standing Orders) Altering vessel position (planned evolution) involves deck personnel in duty section. Moving pier position involves Commanding Officer/Executive Officer Vessels get underway when hurricanes approach	15

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									Qualification standard for in-port OOD, Junior Officer of the Deck (JOOD), and BMOW	
Comments:										
12.4	Vessel struck by floating object		SCREENED							
Comments:										
12.5	Vessel impacts submerged object		Not applicable							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
12.6	Vessel struck by another vessel	Vessel struck by other vessel moving by (or getting underway/mooring near by) or another vessel that loses mooring position A vessel in the process of mooring abreast strikes vessel	Collision with another vessel	3	4	6	0.36	Medium	Periodic rounds by OOD/BMOW to check local traffic and mooring line integrity (Commanding Officer's standing orders, template Cutter Organization Manual) Illuminating vessel lights at night so that the vessel is visible Fenders over the side when vessels tied abreast Established communications with vessel moored abreast or moored nearby BMOW directed to check mooring lines/fenders with vessels tied abreast Qualification standard for in port OOD, JOOD, and BMOW Damage control (flooding) capability	15 22

Comments:

12.7	Physical hazards exposure		SCREENED							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Anchored/moored/stored - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
12.8	Toxic/corrosive/ reactive materials exposure		Not applicable							
Comments:										
12.9	Fire/explosion		SCREENED							
Comments:										
12.10	Asphyxiant environment exposure		Not applicable							
Comments:										
12.11	Electrical hazards exposure		SCREENED							
Comments:										
12.12	High pressure materials exposure		Not applicable							
Comments:										
12.13	High noise exposure		SCREENED							
Comments:										
12.14	Excessive vibration exposure		Not applicable							
Comments:										
12.15	Radiation exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Anchored/moored/stored - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
12.16	Biological hazards exposure		SCREENED							
Comments:										
12.17	Hot/cold environments exposure		SCREENED							
Comments:										
12.18	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.1	Inadequate/no security services	Domestic or foreign civil disturbance causing violence toward the vessel and personnel, thus challenging vessel security capabilities (even with extra personnel on security watch) Inadequately trained watchstanding personnel (have not stood watch in a while, or were not adequately trained during qualification process) Inattentiveness of personnel (fatigue, distractions, morale, sickness) Not enough personnel on security watch during increased security (not on board for deployment, sickness, not available due to vessel maintenance)	Equipment damage/loss Hazardous exposure: contact injury Firearm discharge Fire/explosion	3	3	5	0.063	Medium	Security watch increased during heightened security (extra person on quarterdeck) Personnel armed on quarterdeck during heightened security Place batons and pepper spray near quarterdeck if needed Can use fire hoses to repel people Qualification standard for in-port duty section positions, which addresses security matters, communicating with the OOD, and weapons qualifications Request assistance from local government Request assistance from local police department or state/federal authorities Vessel has listing of personnel qualified to carry weapons, which assists OOD in selecting watchstanders Coast Guard Threat Con levels - using different levels for setting vessel security	23

Table A.1 Coarse Hazard Analysis for WMEC-210

Anchored/moored/stored - Providing security services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									Damage control (fire) capability	

Comments: Includes security service quality problem
Posting armed watchstanders for security (increased levels of security for local disturbances or for foreign nationals) requires a certain level of weapons training and weapons, ammunition, and nonfirearms weapons
Often, vessel ties up in domestic or foreign ports with little/no Coast Guard or Navy security support
Duty section is normally 10 people

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.2	Security services quality problem		See Inadequate/no security							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.3	Physical hazards exposure		SCREENED							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.4	Toxic/corrosive/ reactive materials exposure		SCREENED							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.5	Fire/explosion		SCREENED							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.6	Asphyxiant environment exposure		SCREENED							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.7	Electrical hazards exposure		SCREENED							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.8	High pressure materials exposure		SCREENED							
Comments:										
13.9	High noise exposure		SCREENED							
Comments:										
13.10	Excessive vibration exposure		Not applicable							
Comments:										
13.11	Radiation exposure		SCREENED							
Comments:										
13.12	Biological hazards exposure		SCREENED							
Comments:										
13.13	Hot/cold environments exposure		SCREENED							
Comments: Watches are only for a few hours and personnel can call for assistance										
13.14	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Anchored/moored/stored - Providing assessment/investigation/coordination services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
14.1	Inadequate/no assessment/ investigation/ coordination	Watch stander inattentiveness (fatigue, distractions, morale, sickness)	Equipment damage/loss	3	5	5	0.36	Low	Fire zone alarms	24
		Lack of training for watchstanders (have not stood the watch in a while or were inadequately trained during qualification process)	Fire/explosion						Bilge flooding alarms	25
		Roving watchstanders distracted from making rounds (doing other duties while on rounds, helping other crew members, watching TV, etc.)							Logs taken periodically	
		Incorrect maintenance activity by crew or contractors in between watch stander rounds (fires, leaking fluids/water, etc.)							OOD/EOW review of logs for trends/out-of-specification conditions	
		Inadequate review of watchstanding logs (OOD), Engineer Officer of the Watch (EOW) not detecting trends or conditions out of specification)							Watch standers required to report abnormal conditions by Commanding Officer/Engineering Officer Standing Orders	
		OOD or EOW notified of abnormal conditions, but does not notify appropriate personnel or does not act on condition							Qualification standard for In-port Oiler/Aux Watch, Messenger of the Watch, Gangway Petty Officer of the Watch (Quarterdeck), EOW, and OOD in port	
									Damage control (fire) capability	

Comments: Typically a one-in-four duty section rotation
Require only two engineering watchstanders in the duty section (vessel policy). This could lead to port/starboard watchstanding during duty day
Deviation focuses on material damage

Table A.1 Coarse Hazard Analysis for WMEC-210

Anchored/moored/stored - Providing assessment/investigation/coordination services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
14.2	Assessment/ investigation/ coordination quality problem		See Inadequate/no assessment/investigation/ coordination							
Comments:										
14.3	Physical hazards exposure		SCREENED							
Comments:										
14.4	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
14.5	Fire/explosion		SCREENED							
Comments:										
14.6	Asphyxiant environment exposure		SCREENED							
Comments:										
14.7	Electrical hazards exposure		SCREENED							
Comments:										
14.8	High pressure materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
14.9	High noise exposure		SCREENED							
Comments:										
14.10	Excessive vibration exposure		SCREENED							
Comments:										
14.11	Radiation exposure		SCREENED							
Comments:										
14.12	Biological hazards exposure		SCREENED							
Comments:										
14.13	Hot/cold environments exposure		SCREENED							
Comments:										
14.14	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
15.1	System/equipment unavailable		Not evaluated							
Comments:										
15.2	Poor quality products, service, or operations		SCREENED Fouled screw Vessel collision with fixed object (pier)							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Vessel leaving or returning - Providing industrial systems/equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
15.3	Physical hazards exposure	Miscommunication or delayed communication from bridge to deck supervisor, leading to line strain	Hazardous exposure: contact injury	3	4	5	0.09	Low	Capstan preventive maintenance on electrical/hydraulics	4
		Personnel mispositioned on deck and get caught in line	Equipment damage/loss						Qualifications on deck supervisor/line handlers, phone talkers	5
		Capstan operator misoperates capstan and straining line	Person overboard						Boatswains are trained on looking at line integrity	
		Incorrect order from deck supervisor to capstan operator, leading to line strain							Deck supervisors watch line handling evolution	
		Capstan failure leading to excessive line strain (fails in run position or fails to run, which leads to vessel drifting and straining lines)							Bridge supervisors watch deck evolutions	
		Lack of training leading to improper rigging of the line or improper installation of the stopper, resulting in excessive line strain or line running and catching people in line							Use of standard commands in issuing/reviewing orders	
		Degraded mooring lines snap under normal loading							Lines are normally stored in closed conditions to ensure integrity	

Comments: Personnel may be struck by parted line or may trip over lines on deck

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
15.4	Toxic/corrosive/ reactive materials exposure		Not applicable							
Comments:										
15.5	Fire/explosion		Not applicable							
Comments:										
15.6	Asphyxiant environment exposure		Not applicable							
Comments:										
15.7	Electrical hazards exposure		SCREENED							
Comments:										
15.8	High pressure materials exposure		SCREENED							
Comments:										
15.9	High noise exposure		SCREENED							
Comments:										
15.10	Excessive vibration exposure		Not applicable							
Comments:										
15.11	Radiation exposure		Not applicable							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
15.12	Biological hazards exposure		SCREENED							
Comments:										
15.13	Hot/cold environments exposure		See Vessel in transit/restricted waters, Operating vessels/craft, Hot/cold environment exposure							
Comments:										
15.14	Hot/cold surfaces/materials exposure		Not applicable							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Vessel leaving or returning - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.1	Vessel/craft unavailable		SCREENED							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Vessel leaving or returning - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.2	Incorrect position/direction/ speed	Incorrect chart information leading vessel into shoal water OOD miscommunication or poor communications with deck personnel in directing line handling Mechanical/electrical failure of pilot house controls Mechanical failure of one/both main diesel engines (more likely for losing one main diesel engine [MDE]; electrical problem in controllable pitch propulsion [CPP], which is more likely than hydraulic problem) Electrical failure of gyro compass, giving incorrect information to helmsman/OOD Absence of aids to navigation, leading vessel into incorrect position Helmsman error in interpreting OOD orders OOD error in issuing commands (includes confusion due to multiple personnel on bridge and error in reading charts) Engine room error in testing MDEs prior to getting underway	Hazardous exposure: contact injury Collision with another vessel Collision with a fixed object Collision with a floating object Grounding vessel Fouled screw Equipment damage/loss Person overboard	4	4	6	0.63	Low	Engine room uses a leaving port/entering port checklist for propulsion systems Periodic fixes on vessel position per COMDT instruction Knowledge of expected weather conditions in certain ports (checklist and navigation brief) Commanding officer approves navigation plans for leaving/entering port Using other vessels for underway training of personnel Specific procedures for rocking the shafts (testing MDEs prior to getting underway) Written underway/entering port checklist Captain is a safety supervisor for bridge operations Executive officer is a safety supervisor on the bridge (role of "Coach") Use of standard commands in issuing/receiving	2 6

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
		OOD error in testing MDEs prior to getting underway							communications	
		Misjudgment in estimating local environmental conditions							Rudder angle indicators and gyro repeaters are on bridge wings (OOD can check on helm orders)	
		Sudden change in local environmental conditions							Training - use of helm standard commands	
		Vessel strikes unknown submerged object							Qualification standard - helmsman, OOD, phone talker, line handler, safety supervisor (deck) (qualification standard for all watch stations)	
		Passing vessel traffic strikes Coast Guard vessel							Underway/entering port checklist ensures OOD and Combat Information Center (CIC) are in agreement on vessel position (CIC runs a navigation plot)	
									Navigation brief for underway/entering port (includes weather update)	
									Use of COMDT and Navy (NAV) standards for correcting charts	
									Preventive maintenance on pilot house controls (electrical)	
									Engine room preventive maintenance on MDEs (fuel oil, lube oil, turbocharger,	

Vessel leaving or returning - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									compression, etc.) Preventive maintenance on CPP - electrical signals and hydraulics Use of local traffic control to identify vessel traffic in the area Damage control (flooding) capability Training - conning officer (OOD) under instruction Properly positioned and functioning aids to navigation	

Comments: Bridge wing propulsion control not tested as part of underway preparation
Line handling communications are OOD to phone talker, phone talker to local phone talker, local phone talker to local supervisor, and local supervisor to line handler (chance for delayed communications or wrong communications)
Fatigue is a large factor in vessel operations (particularly in open water operations)
Miscommunication between OOD or bridge personnel is the largest factor (verbal communication; using so many phone talkers in talking with deck personnel; too many bridge personnel, considering watchstanders, new personnel, and safety supervisors)
Experienced personnel are heavily relied on for training new personnel
A single vessel may do 50 moorings/unmoorings a year. There are about 30 WMEC-210 vessels in the fleet (1,500 moorings/unmoorings a year)
Although A/B and C listed as %, C is more frequent within 5 frequency category

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.3	Vessel/craft fails to maintain position		See Incorrect position/direction/speed							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.4	Vessel struck by floating object		See Incorrect position/direction/speed							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.5	Vessel impacts submerged object		See Incorrect position/direction/speed							
Comments:										
16.6	Vessel struck by another vessel		See Incorrect position/direction/speed							
Comments:										
16.7	Physical hazards exposure		SCREENED							
Comments:										
16.8	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
16.9	Fire/explosion		SCREENED							
Comments:										
16.10	Asphyxiant environment exposure		SCREENED							
Comments:										
16.11	Electrical hazards exposure		SCREENED							
Comments:										
16.12	High pressure materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.13	High noise exposure		SCREENED							
Comments:										
16.14	Excessive vibration exposure		SCREENED							
Comments:										
16.15	Radiation exposure		SCREENED							
Comments:										
16.16	Biological hazards exposure		Not applicable							
Comments:										
16.17	Hot/cold environments exposure		See Hot/Cold environments exposure - vessel in transit/restricted waters							
Comments:										
16.18	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Vessel in transit/restricted waters - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.1	Vessel/craft unavailable		SCREENED							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Vessel in transit/restricted waters - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.2	Incorrect position/direction/ speed	Incorrect chart information, leading vessel into shoal water Electrical failure of gyro compass, giving incorrect information to helmsman/OOD Absence of aids to navigation, leading vessel into incorrect position (particularly in Caribbean nations) Helmsman error in interpreting OOD orders Misjudgment in estimating local environmental conditions (particularly visibility) Difficulty in communicating with other vessels, leading to vessel collision Incorrect information from pilot Poor visibility Vessel speed too fast for given conditions Mechanical failure of one/both MDEs (more likely for losing one MDE; electrical problem in CPP, which is more likely than hydraulic problem) OOD error in issuing commands (includes confusion due to	Collision with another vessel Collision with a fixed object Collision with a floating object Grounding vessel Fouled screw Hazardous exposure: contact injury Equipment damage/loss Person overboard	3	4	5	0.09	Medium	Use of pilot when needed Properly positioned and functioning aids to navigation Use of radar in limited visibility Periodic fixes on vessel position per COMDT and Commanding Officer instructions Knowledge of expected weather conditions in certain ports (checklist and navigation brief) Commanding officer approves navigation plans for leaving/entering port Use of local pilot when needed Using other vessels for underway training of personnel Captain is a safety supervisor for bridge operations An experienced conning officer is a safety supervisor on the bridge (role of "Coach") Use of standard commands in	1 3 6

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
		multiple personnel on bridge and error in reading charts)							issuing/receiving communications	
		Sudden change in local environmental conditions							Rudder angle indicators and gyro repeaters are on bridge wings (OOD can check on helm orders)	
		Vessel strikes unknown submerged object							Training - helm standard command, conning officer (OOD) under instruction, restricted visibility	
		Passing vessel traffic strikes Coast Guard vessel							Qualification standard - helmsman, OOD, phone talker, line handler, safety supervisor (deck) (qualification standard for all watch stations)	
									Navigation brief for underway/entering port (includes weather update)	
									Use of COMDT and NAV standards for correcting charts	
									Comparison of vessel position between bridge and CIC	
									Maritime publications - U.S. Ports Coastal Pilot regulations, Fleet guides, etc. (e.g., using security radio calls to notify local vessels that the vessel is in transit)	
									Use of local traffic control to	

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									identify vessel traffic in the area Preventive maintenance on pilot house controls (electrical) Engine room preventive maintenance on MDEs (fuel oil, lube oil, turbocharger, compression, etc.) Preventive maintenance on CPP - electrical signals and hydraulics Damage control (flooding) capability	

Comments: Commanding Officer has vessel tracking system experience in seeing vessels strike bridge abutments. However, navigation brief should capture this

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.3	Vessel/craft fails to maintain position		See Incorrect position/direction/speed							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.4	Vessel struck by floating object		See Incorrect position/direction/speed							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.5	Vessel impacts submerged object		See Incorrect position/direction/speed							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Vessel in transit/restricted waters - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.6	Vessel struck by another vessel		See Incorrect position/direction/speed							
Comments:										
17.7	Physical hazards exposure		SCREENED							
Comments:										
17.8	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
17.9	Fire/explosion		SCREENED							
Comments:										
17.10	Asphyxiant environment exposure		SCREENED							
Comments:										
17.11	Electrical hazards exposure		SCREENED							
Comments:										
17.12	High pressure materials exposure		SCREENED							
Comments:										
17.13	High noise exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.14	Excessive vibration exposure		SCREENED							
Comments:										
17.15	Radiation exposure		SCREENED							
Comments:										
17.16	Biological hazards exposure		Not applicable							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Vessel in transit/restricted waters - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.17	Hot/cold environments exposure	Severe ice buildup on vessel due to local weather conditions causing vessel instability Slippery deck due to weather conditions Inappropriate gear for the weather conditions Misjudgment of local weather conditions, leading to personnel exposures (in adequate gear) Extension of anchor or special sea detail while personnel not protected with gear Personnel exposed to heat and humidity environment in the engine room (especially in warmer climates)	Hazardous exposure: hot environment/surface/material Hazardous exposure: cold environment/surface/material Person overboard Hazardous exposure: contact injury Capsizing vessel (ice buildup)	1	2	6	0.3006	Medium	Established deicing procedures Contingency plans for extended personnel exposures on deck Deck safety supervisors watching for proper protection Bridge safety supervisor watching for proper protection Deck personnel wear PFDs and hard hats Periodic training for all hands on heat stress, cold exposure (also trained to advise others when there is a problem) Wet bulb globe temperature meter in engine room Heat stress management trained for engine room Command rotates personnel in heat stress environment per health and safety guidelines Command ensures that adequate fluids are available for consumption per health and safety guidelines	

Comments: WMEC-210 fleet has more heat exposure than cold exposure

Table A.1 Coarse Hazard Analysis for WMEC-210

Vessel in transit/restricted waters - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.18	Hot/cold surfaces/materials exposure		SCREENED							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
18.1	Vessel/craft unavailable		SCREENED							

Comments:

Not operation/evolution specific - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
18.2	Incorrect position/direction/ speed	Incorrect chart information, leading vessel into shoal water Electrical failure of gyro compass, giving incorrect information to helmsman/OOD Helmsman error in interpreting OOD orders Misjudgment in estimating local environmental conditions (particularly visibility) Difficulty in communicating with other vessels leading to vessel collision Poor visibility Vessel speed too fast for given conditions Mechanical failure of one/both MDEs (more likely for losing one MDE; electrical problem in CPP, which is more likely than hydraulic problem) Sudden change in local environmental conditions	Collision with another vessel Collision with a fixed object Collision with a floating object Grounding vessel Fouled screw Person overboard Equipment damage/loss Hazardous explosive: contact injury	2	3	4	0.009	Medium	Use of radar in limited visibility Periodic fixes on vessel position per COMDT and Commanding Officer instructions Knowledge of expected weather conditions underway Using other vessels for underway training of personnel Use of standard commands in issuing/receiving communications Rudder angle indicators and gyro repeaters are on bridge wings (OOD can check on helm orders) Training - helm standard command, conning officer (OOD) under instruction, restricted visibility Qualification standard - helmsman, OOD, phone talker, line handler, safety supervisor (deck) (qualification standard for all watchstations) Use of COMDT and NAV standards for correcting charts	6

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									Maritime publications - U.S. Ports Coastal Pilot regulations, Fleet guides, etc. (e.g., using security radio calls to local vessels that the vessel is in transit) Preventive maintenance on pilot house controls (electrical) Engine room preventive maintenance on MDEs (fuel oil, lube oil, turbocharger, compression, etc.) Preventive maintenance on CPP - electrical signals and hydraulics Damage control (flooding) capability	
Comments: Open water operations										
18.3	Vessel/craft fails to maintain position		SCREENED							
Comments:										
18.4	Vessel struck by floating object		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
18.5	Vessel impacts submerged object		SCREENED							
Comments:										
18.6	Vessel struck by another vessel		SCREENED							
Comments:										
18.7	Physical hazards exposure		SCREENED							
Comments:										
18.8	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
18.9	Fire/explosion		SCREENED							
Comments:										
18.10	Asphyxiant environment exposure		SCREENED							
Comments:										
18.11	Electrical hazards exposure		SCREENED							
Comments:										
18.12	High pressure materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Operating vessels/craft

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
18.13	High noise exposure		SCREENED							
Comments:										
18.14	Excessive vibration exposure		SCREENED							
Comments:										
18.15	Radiation exposure		SCREENED							
Comments:										
18.16	Biological hazards exposure		Not applicable							
Comments:										
18.17	Hot/cold environments exposure		SCREENED							
Comments:										
18.18	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
19.1	Lifting equipment unavailable		SCREENED							
Comments:										
19.2	Loss of support	Structural failure (e.g., faulty weld on support, failure of support material) Improper use of chain fall Lack of experience using lifting equipment Misoperation of the lifting/lowering equipment	Equipment damage/loss Hazardous exposure: contact injury	2	3	6	0.306	Medium	Supervisor checks/observes operation Periodic static test of structural supports Periodic load test of chain falls Standard procedures for lifting/lowering	54
Comments:										
19.3	Incorrect load position/direction/ speed		SCREENED						Lifting heavy objects is only performed during good weather/sea conditions	
Comments:										
19.4	Physical hazards exposure	Lack of experience using lifting equipment Lifting is often required in tight quarters Improper use of equipment Personnel error (e.g., inattention, inexperience, not following procedure)	Hazardous exposure: contact injury	2	3	6	0.306	Medium	Supervisor checks/observes operation Standard procedures for lifting/lowering	
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Operating lifting equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
19.5	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
19.6	Fire/explosion		SCREENED							
Comments:										
19.7	Asphyxiant environment exposure		SCREENED							
Comments:										
19.8	Electrical hazards exposure		SCREENED							
Comments:										
19.9	High pressure materials exposure		SCREENED							
Comments:										
19.10	High noise exposure		SCREENED							
Comments:										
19.11	Excessive vibration exposure		SCREENED							
Comments:										
19.12	Radiation exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Operating lifting equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
19.13	Biological hazards exposure		SCREENED							
Comments:										
19.14	Hot/cold environments exposure		SCREENED							
Comments:										
19.15	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.1	Excessive static structural loading		Not evaluated							
Comments:										
20.2	Excessive dynamic structural loading		Not evaluated							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.3	Structural degradation	Inspection/maintenance neglected because vessel coming up on extended maintenance period	SCREENED						MATs help in structural preventive maintenance	27
		Rapid turnover of management personnel, leading to delayed/neglected maintenance/inspection	Sinking vessel						MLC Assist Teams help in specialized structural projects	28
		Vessel personnel experiencing heavy workload (and changing priorities) and delay/neglect maintenance /inspection - unavailable personnel due to sickness, must author administrative reports, excessive duty rotation, training requirements	Equipment damage/loss - watertight doors exposed to weather						NESU provides structural preventive maintenance support	
		Heavy vessel operational schedule, causing delayed/neglected maintenance/inspection							Post-mishap investigations may identify missed preventive maintenance as a contributor	
		Maintenance/inspection not performed by Material Assistance Teams (MATs), and the Naval Engineering Support Unit (NESU) and is delayed/neglected							Adherence to published preventive maintenance schedule (COMDINST Tech Pub 2006.8 gives instructions)	
		Inadequate attention given to lifelines/stations							Vessel drills discover structural deficiencies (especially water-tight doors)	
		Inadequate attention given to small boat davits - lack of lubrication, cables frayed							Vessel material inspections discover deficiencies	
									Safety and health audits discover deficiencies	
									Damage Control Leading Petty Officer monitors preventive maintenance accomplishment	
									Use private contractors for large portions of deck maintenance/testing (e.g.,	

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
									weight testing) Can obtain replacement components for deck equipment from local companies	

Comments: Structural preventive maintenance: Watertight doors inspection, watertight test on spaces, airtight tests on spaces, vessel inspection/contract inspection of hull integrity
Flight deck maintenance done by contractor and under scrutiny of Navy. Deck Division does very little maintenance on flight deck

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.4	Physical hazards exposure	Struck by falling equipment while in dry dock or dock side availability Eye injury from preservation preventive maintenance (sandblasting, grinding, chipping) Fingers/limbs caught or struck by handle while doing watertight door preventive maintenance Contact injury from moving equipment during structural preventive maintenance Physical impact from working on deck equipment	Hazardous exposure: contact injury	2	4	6	0.333	Medium	PPE - hard hats, eye protection, gloves, goggles Safety officer briefs prior to shipyard or dock side availability MLC Health and Safety briefs prior to shipyard or dock side availability Establish and announced safety zones around work area Supervisory attention during deck maintenance	

Comments: Class D mishaps driven by Deck Division maintenance

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing/maintaining structures

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.5	Toxic/corrosive/ reactive materials exposure	Using hazardous materials (HAZMAT) during deck maintenance (unprotected exposure)	Hazardous exposure: toxic/corrosive materials	2	3	6	0.306	Low	PPE - gloves, goggles MSDS for HAZMAT Supervisory attention during deck maintenance HAZCOM program Periodic HAZMAT training	
Comments:										
20.6	Fire/explosion		SCREENED							
Comments:										
20.7	Asphyxiant environment exposure	Working in paint locker with no ventilation Improper confined space entry by Deck Division	SCREENED						Paint locker ventilation Most confined space work performed by private contractors	
Comments:										
20.8	Electrical hazards exposure	Electrical tools damaged during maintenance, exposing electrical cables Use faulty electrical tools during deck maintenance	Hazardous exposure: electrical shock	2	3	5	0.036	Medium	PPE - gloves, goggles Supervisory attention during deck maintenance Electrical tools safety checked Use pneumatic tools for deck maintenance	60
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing/maintaining structures

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.9	High pressure materials exposure		SCREENED							
Comments:										
20.10	High noise exposure		SCREENED							
Comments:										
20.11	Excessive vibration exposure		SCREENED							
Comments:										
20.12	Radiation exposure		SCREENED							
Comments:										
20.13	Biological hazards exposure		SCREENED							
Comments:										
20.14	Hot/cold environments exposure	Deck division maintenance in the heat	Hazardous exposure: hot environment/surface material	2	3	5	0.036	Medium	Periodic heat stress/heat stroke training by the corpsman Sunscreen Supervisory attention to heat stress/heat stroke	
Comments:										
20.15	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing industrial systems/equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
21.1	System/equipment unavailable	Inexperienced personnel Mechanical failure of fuel oil purifier Mechanical failure of oily water separator	SCREENED Equipment damage/loss Mission impact - loss of purifier						Operating procedures for separator and purifier Preventive maintenance for the fuel oil purifier	
Comments:										
21.2	Poor quality products, service, or operations	Improper supervision of tasks Inexperience of personnel operating equipment Inferior quality supplies and parts used in the task	SCREENED Equipment damage/loss Hazardous exposure: contact injury						Quality assurance (QA) of parts used in maintenance QA of work being performed On-the-job training for using different equipment	
Comments:										
21.3	Physical hazards exposure	Lifting heavy parts in tight quarters Weather/sea conditions	Hazardous exposure: contact injury - strain, caught in or between	1	5	6	0.6003	Medium	Assessment of job hazards before performing job Periodic refresher training on the correct way to lift heavy objects Back belts for heavy lifting PPE - gloves, steel-toed shoes	
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing industrial systems/equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
21.4	Toxic/corrosive/ reactive materials exposure	Inattention when using chemicals Normal maintenance of equipment	Hazardous exposure: toxic/corrosive materials Hazardous exposure: contact injury - chemical burn	2	3	6	0.306		PPE - chemical gloves, respirators, face shield, apron Training and instructions on using chemicals Material safety data sheets (MSDSs) on materials Procedures in place that require review of MSDSs before using some materials Eyewash station	
Comments:										
21.5	Fire/explosion	Ruptured hose or flexible fuel oil line and spraying on hot surface (engine room, aft steering, JP-5, forward auxiliary) Improperly installing fuel oil line, leading to fuel oil spray on hot surface (engine room, aft steering, JP-5, forward auxiliary) Improper maintenance, leading to fuel oil spray on hot surface Inadequate quality of hoses or wrong parts used, leading to fuel oil spray on hot surface	Fire/explosion	2	2	1	0.0033	Medium	Flange shields on some lines Supervision (e.g., QA of work performed) Fire extinguishers AFFF in engine room, aft steering, JP-5, forward auxiliary AFFF in bilge of engine room Alarm system Damage control (fire) capability	
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing industrial systems/equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
21.6	Asphyxiant environment exposure		SCREENED							
Comments:										
21.7	Electrical hazards exposure		SCREENED							
Comments:										
21.8	High pressure materials exposure		SCREENED							
Comments:										
21.9	High noise exposure		SCREENED						Extensive hearing conservation program	
Comments:										
21.10	Excessive vibration exposure		SCREENED							
Comments:										
21.11	Radiation exposure		SCREENED							
Comments:										
21.12	Biological hazards exposure		SCREENED							
Comments:										
21.13	Hot/cold environments exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing industrial systems/equipment

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
21.14	Hot/cold surfaces/materials exposure		SCREENED							

Comments:

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing electronic systems services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
22.1	Inadequate/no electronic systems service	Loss of electricity Failure of electronics boards	Collision with another vessel Collision with a fixed object Collision with a floating object Grounding vessel	2	2	2	0.00333	High	Preventive maintenance on electronics (radar systems and other electronics equipment) Celestial navigating equipment can be used as a backup Backup radar system Damage control (flooding) capability	

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
22.2	Electronic systems service quality problem	Inexperience of personnel operating/reading radar Failure of equipment (electronics and antenna) Lack of attention to radar information	Collision with another vessel Collision with a fixed object Collision with a floating object Grounding vessel	4	4	5	0.36	Medium	Backup radar system PQS for radar personnel (conning personnel) Deck watch officers watching for collision hazards Celestial navigating equipment can be used as a backup Preventive maintenance on electronics (radar systems and other electronics equipment) Damage control (flooding) capability	

Comments:

Not operation/evolution specific - Providing electronic systems services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
22.3	Physical hazards exposure		SCREENED							
Comments:										
22.4	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
22.5	Fire/explosion		SCREENED							
Comments:										
22.6	Asphyxiant environment exposure		SCREENED							
Comments:										
22.7	Electrical hazards exposure		SCREENED							
Comments:										
22.8	High pressure materials exposure		SCREENED							
Comments:										
22.9	High noise exposure		SCREENED							
Comments:										
22.10	Excessive vibration exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing electronic systems services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
22.11	Radiation exposure		SCREENED						Extensive tag out system for working on equipment No one is around radar antenna during operation	
Comments:										
22.12	Biological hazards exposure		SCREENED							
Comments:										
22.13	Hot/cold environments exposure		SCREENED							
Comments:										
22.14	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing electrical power services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
23.1	Inadequate/no electrical power service	Excessive electrical load Mechanical failure of generator Fuel spray on generator Ground fault in generator	Collision with a floating object Hazardous exposure: hot environment - loss of ventilation in engine room Equipment damage/loss Hazardous exposure: contact injury Collision with another vessel Collision with a fixed object - loss of steering until emergency diesel generator comes up	1	4	5	0.0603	Medium	Emergency generator Both generators are on line during critical operations Ground detector lights on generators to warn of a fault Damage control (flooding) capability	
Comments:										
23.2	Incorrect electrical power frequency/voltage/ phase		SCREENED							
Comments:										
23.3	Physical hazards exposure		SCREENED							
Comments:										
23.4	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										
23.5	Fire/explosion		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing electrical power services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
23.6	Asphyxiant environment exposure		SCREENED							
Comments:										
23.7	Electrical hazards exposure	Maintenance on switchboard (usually must be performed with switchboard live) Maintenance on live 440-volt circuits Fault in generator Fault in distribution line	Hazardous exposure: electrical shock - main switchboard	3	5	6	0.63	Medium	Tag out procedure when performing maintenance Cane to pull someone off of circuit during maintenance of live circuit PPE - high voltage rubber gloves during an electrical casualty Electrical equipment must be in spaces with a dielectric mat	59
Comments:										
23.8	High pressure materials exposure		SCREENED							
Comments:										
23.9	High noise exposure		SCREENED							
Comments:										
23.10	Excessive vibration exposure		SCREENED							
Comments:										
23.11	Radiation exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing electrical power services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
23.12	Biological hazards exposure		SCREENED							
Comments:										
23.13	Hot/cold environments exposure		SCREENED							
Comments:										
23.14	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing food services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
24.1	Inadequate/no food services		SCREENED							
Comments:										
24.2	Food quality problem		SCREENED							
Comments: Have not seen or heard of sickness related to food services										
24.3	Physical hazards exposure		SCREENED							
Comments:										
24.4	Toxic/corrosive/ reactive materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing food services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
24.5	Fire/explosion	Mechanical/electrical failure of thermostat on deep fryer Grease spill on stove/fryer Failure of stove/oven/fryer elements Weather/sea conditions	Fire/explosion Hazardous exposure: contact injury Equipment damage/loss	2	3	3	0.0063	Medium	Preventive maintenance for fryer and oven Training on how to use fire prevention equipment Fire extinguisher PKP and APC fire extinguishers to extinguish fryer Remote actuation of extinguishing system in galley Alarm system Damage control (fire) capability	
Comments:										
24.6	Asphyxiant environment exposure		SCREENED							
Comments:										
24.7	Electrical hazards exposure		SCREENED							
Comments:										
24.8	High pressure materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing food services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
24.9	High noise exposure		SCREENED							
Comments:										
24.10	Excessive vibration exposure		SCREENED							
Comments:										
24.11	Radiation exposure		SCREENED							
Comments:										
24.12	Biological hazards exposure		SCREENED							
Comments:										
24.13	Hot/cold environments exposure		SCREENED							
Comments:										
24.14	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing warehousing services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.1	Inadequate/no warehousing service		SCREENED							
Comments:										
25.2	Warehousing quality problem		SCREENED							
Comments:										
25.3	Physical hazards exposure	Supplies/materials stored improperly (e.g., stacked too high, stored in walkway)	Hazardous exposure: contact injury	2	3	5	0.036	Medium	Inspection of locations and materials DCPO inspection (ensuring spaces are clear) BMOW inspection (security rounds)	55
Comments:										
25.4	Toxic/corrosive/ reactive materials exposure	Failure to safely maintain inventory (e.g., damaged/corroded containers) Incompatible materials stored together	Hazardous exposure: toxic corrosive/materials Hazardous exposure: contact injury	2	3	5	0.036	Medium	HAZMAT training MSDSs are maintained for hazardous materials PPE - respirators, eye protection, chemical gloves, aprons Ventilation in paint locker and HAZMAT areas Toxic gas bill Eyewash stations	55
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing warehousing services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.5	Fire/explosion	Poor housekeeping (e.g., rags left laying around) Mixing or close storage of incompatible materials (e.g., oxidizers and flammables)	Fire/explosion Equipment damage/loss	2	3	2	0.00603	Medium	Inspections of storage spaces Centralized storage of flammable materials MSDS for flammables and corrosives CO2 in paint locker for extinguishing fires Magazine sprinkler Central alarm system Security rounds Ventilation in storage spaces Damage control (fire) capability	55
Comments:										
25.6	Asphyxiant environment exposure		SCREENED							
Comments:										
25.7	Electrical hazards exposure		SCREENED							
Comments:										
25.8	High pressure materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing warehousing services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.9	High noise exposure		SCREENED							
Comments:										
25.10	Excessive vibration exposure		SCREENED							
Comments:										
25.11	Radiation exposure		SCREENED							
Comments:										
25.12	Biological hazards exposure		SCREENED							
Comments:										
25.13	Hot/cold environments exposure		SCREENED							
Comments:										
25.14	Hot/cold surfaces/materials exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing assessment/investigation/coordination services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
26.1	Inadequate/no assessment/ investigation/ coordination		SCREENED							
Comments:										
26.2	Assessment/ investigation/ coordination/ quality problem	Fatigue of watch stander	Equipment damage/loss	2	4	5	0.063	Medium	Central fire/smoke alarms	56
		Inexperience of watch stander	Flooding						Flooding alarms	57
		Lack of attention to details during watch	Fire/explosion						Rotation of watch personnel (provides a different perspective of what is reviewed and how thoroughly things are reviewed)	58
									Damage control (fire) capability	
Comments:										
26.3	Physical hazards exposure		SCREENED							
Comments:										
26.4	Toxic/corrosive/ reactive materials exposure	Watch stander discovers a leak or filled space and does not have the appropriate PPE	Hazardous exposure: toxic/corrosive materials	-	-	5	0.03	Low	Personnel are trained to be aware of these situations	
Comments:										
26.5	Fire/explosion		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
26.6	Asphyxiant environment exposure		SCREENED							
Comments:										
26.7	Electrical hazards exposure		SCREENED							
Comments:										
26.8	High pressure materials exposure		SCREENED							
Comments:										
26.9	High noise exposure		SCREENED							
Comments:										
26.10	Excessive vibration exposure		SCREENED							
Comments:										
26.11	Radiation exposure		SCREENED							
Comments:										
26.12	Biological hazards exposure		SCREENED							
Comments:										
26.13	Hot/cold environments exposure		SCREENED							
Comments:										

Table A.1 Coarse Hazard Analysis for WMEC-210

Not operation/evolution specific - Providing assessment/investigation/coordination services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
26.14	Hot/cold surfaces/materials exposure		SCREENED							

Comments:

ATTACHMENT B

Coarse Hazard Analysis Recommendations
Risk Reduction Estimates

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 1 — Consider researching the benefits of the vessel tracking system (VTS) to understand the value of VTS in ports where the service is established.	**Vessel in transit/restricted waters** *Operating vessels/craft* Incorrect position/direction/speed (Item 17.2)	0.09 (3,4,5)				
	TOTAL	0.09				
Recommendation 2 — Consider mandating the use of tugs/pusher boats in mooring/unmooring operations.	**Vessel leaving or returning** *Operating vessels/craft* Incorrect position/direction/speed (Item 16.2)	0.63 (4,4,6)				
	TOTAL	0.63				
Recommendation 3 — Consider promoting a better understanding of navigation rules among recreational boaters.	**Vessel in transit/restricted waters** *Operating vessels/craft* Incorrect position/direction/speed (Item 17.2)	0.09 (3,4,5)				
	TOTAL	0.09				
Recommendation 4 — Consider implementing a more expedient form of communications between the bridge and the deck during line handling evolutions.	**Vessel leaving or returning** *Providing industrial systems/equipment* Physical hazards exposure (Item 15.3)	0.09 (3,4,5)				
	TOTAL	0.09				
Recommendation 5 — Consider increasing the frequency of line handling evolution training.	**Vessel leaving or returning** *Providing industrial systems/equipment* Physical hazards exposure (Item 15.3)	0.09 (3,4,5)				
	TOTAL	0.09				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 6 — Consider promoting the use of local ship-driving simulators for training vessel personnel.	**Vessel leaving or returning** *Operating vessels/craft* Incorrect position/direction/speed (Item 16.2)	0.63 (4,4,6)				
	Vessel in transit/restricted waters *Operating vessels/craft* Incorrect position/direction/speed (Item 17.2)	0.09 (3,4,5)				
	Not operation/evolution specific *Operating vessels/craft* Incorrect position/direction/speed (Item 18.2)	0.009 (2,3,4)				
	TOTAL	0.73				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 7 — Consider performing additional walkthrough evolutions for damage control with only a limited amount of equipment before conducting walkthrough evolutions with full damage control equipment.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	Damage control — fire *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Fire/explosion (Item 4.5)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Electrical hazards exposure (Item 4.7)	0.0063 (2,3,3)				
	Damage control — flood *Providing flood control services* Physical hazards exposure (Item 5.3)	0.333 (2,5,5)				
	Damage control — flood *Providing flood control services* Electrical hazards exposure (Item 5.7)	0.009 (2,3,4)				
	TOTAL	1.0				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 8 — Consider medically screening for claustrophobia those vessel personnel assigned to damage control duties.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	Damage control — fire *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Fire/explosion (Item 4.5)	0.036 (2,4,4)				
	TOTAL	0.68				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 9 — Consider additional damage control cross-training for vessel personnel.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	Damage control — fire *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Fire/explosion (Item 4.5)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Electrical hazards exposure (Item 4.7)	0.0063 (2,3,3)				
	Damage control — flood *Providing flood control services* Physical hazards exposure (Item 5.3)	0.333 (2,5,5)				
	Damage control — flood *Providing flood control services* Electrical hazards exposure (Item 5.7)	0.009 (2,3,4)				
	Damage control — flood *Providing flood control services* Hot/cold environments exposure (Item 5.13)	0.009 (2,3,4)				
	TOTAL	1.0				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 10 — Consider using local firefighting training facilities for training vessel personnel in damage control events.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	Damage control — fire *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Fire/explosion (Item 4.5)	0.036 (2,4,4)				
	TOTAL	0.68				
Recommendation 11 — Consider promoting shipboard familiarization visits by local fire departments.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	Damage control — fire *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Fire/explosion (Item 4.5)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Electrical hazards exposure (Item 4.7)	0.0063 (2,3,3)				
	TOTAL	0.68				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 12 — Consider incorporating safety and damage control inspections with material inspections and increasing the frequency of these inspections.	**Damage control — fire** *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Fire/explosion (Item 4.5)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Electrical hazards exposure (Item 4.7)	0.0063 (2,3,3)				
	TOTAL	0.08				
Recommendation 13 — Consider developing Tailored Shipboard Training Assessment (TSTA) damage control scenarios that require numbers of personnel more in line with expected vessel manning.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	Damage control — fire *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Fire/explosion (Item 4.5)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Electrical hazards exposure (Item 4.7)	0.0063 (2,3,3)				
	Damage control — flood *Providing flood control services* Physical hazards exposure (Item 5.3)	0.333 (2,5,5)				
	Damage control — flood *Providing flood control services* Electrical hazards exposure (Item 5.7)	0.009 (2,3,4)				
	TOTAL	1.0				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 14 — Consider using portable AFFF extinguishers on board vessels.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	Damage control — fire *Providing fire services* Fire/explosion (Item 4.5)	0.036 (2,4,4)				
	TOTAL	0.64				
Recommendation 15 — Consider enhancing all-hands training (in-port training) to include reporting unusual vessel traffic or nearby vessels getting underway to the OOD.	**Anchored/moored/stored** *Operating vessels/craft* Vessel struck by another vessel (Item 12.6)	0.36 (3,4,6)				
	Anchored/moored/stored *Operating vessels/craft* Vessel/craft fails to maintain position (Item 12.3)	Screened				
	TOTAL	0.36				
Recommendation 16 — Consider sending additional vessel personnel to basic damage control school (flooding school).	**Damage control — flood** *Providing flood control services* Physical hazards exposure (Item 5.3)	0.333 (2,5,5)				
	Damage control — flood *Providing flood control services* Electrical hazards exposure (Item 5.7)	0.009 (2,3,4)				
	Damage control — flood *Providing flood control services* Hot/cold environments exposure (Item 5.13)	0.009 (2,3,4)				
	TOTAL	0.35				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 17 — Once new personnel are identified for sea duty, consider sending them to some type of damage control training before arriving at a vessel.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	Damage control — fire *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Fire/explosion (Item 4.5)	0.036 (2,4,4)				
	Damage control — fire *Providing fire services* Electrical hazards exposure (Item 4.7)	0.0063 (2,3,3)				
	Damage control — flood *Providing flood control services* Physical hazards exposure (Item 5.3)	0.333 (2,5,5)				
	Damage control — flood *Providing flood control services* Electrical hazards exposure (Item 5.7)	0.009 (2,3,4)				
	Damage control — flood *Providing flood control services* Hot/cold environments exposure (Item 5.13)	0.009 (2,3,4)				
	TOTAL	1.0				
Recommendation 18 — Consider more frequent training on identifying and handling hazardous materials (HAZMAT).	**Damage control — fire** *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	TOTAL	0.036				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 19 — Consider enhancing HAZMAT training to include training all hands on hazardous materials found in each compartment.	**Damage control — fire** *Providing fire services* Toxic/corrosive/reactive materials exposure (Item 4.4)	0.036 (2,4,4)				
	TOTAL	0.036				
Recommendation 20 — Consider using thermal imager and O_2 sampler mock-ups instead of actual equipment during damage control drills.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	TOTAL	0.6				
Recommendation 21 — Consider not grading TSTA or underway drills.	**Damage control — fire** *Providing fire services* Physical hazards exposure (Item 4.3)	0.603 (2,5,6)				
	TOTAL	0.6				
Recommendation 22 — Consider requiring that inport OODs establish communications with nearby vessels or local port authorities.	**Anchored/moored/stored** *Operating vessels/craft* Vessel struck by another vessel (Item 12.6)	0.36 (3,4,6)				
	TOTAL	0.36				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 23 — Consider establishing standard procedures for requesting local assistance (domestic and foreign) and establishing specific vessel security measures for increased security situations (consistent with Coast Guard Threat Con levels).	**Anchored/moored/stored** *Providing security services* Inadequate/no security services (Item 13.1)	0.063 (3,3,5)				
	TOTAL	0.063				
Recommendation 24 — Consider increasing the use of remote alarm systems on critical vessel systems and increasing the number of alarm channels for existing alarm systems (e.g., multiple flooding alarm levels for each monitored bilge).	**Anchored/moored/stored** *Providing assessment/investigation/ coordination services* Inadequate/no assessment/investigation/ coordination services (Item 14.1)	0.36 (3,5,5)				
	TOTAL	0.36				
Recommendation 25 — Consider monitoring CASREP reports for equipment/system failure trends.	**Anchored/moored/stored** *Providing assessment/investigation/ coordination services* Inadequate/no assessment/investigation/ coordination services (Item 14.1)	0.36 (3,5,5)				
	TOTAL	0.36				
Recommendation 26 — Consider performing quality assurance checks on the accuracy of the electrical securing schedule after maintenance periods.	**Damage control — flood** *Providing flood control services* Electrical hazards exposure (Item 5.7)	0.009 (2,3,4)				
	TOTAL	0.009				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 27 — Consider sending more vessel damage control personnel to Damage Control Petty Officer School (DCPO School).	**Not operation/evolution specific** *Providing/maintaining structures* Structural degradation (Item 20.3)	Screened				
	TOTAL	—				
Recommendation 28 — Consider increasing the availability of the Material Assistance Team (MAT) and the Naval Engineering Support Unit (NESU) teams for vessel support in vessel downsizing.	**Not operation/evolution specific** *Providing/maintaining structures* Structural degradation (Item 20.3)	Screened				
	TOTAL	—				
Recommendation 29 — Consider periodically training the helicopter team on the use and hazards of the hot start equipment.	**Helicopter operations** *Providing electrical power services* Incorrect electrical power/frequency/ voltage/phase (Item 8.2)	0.0036 (2,2,3)				
	Helicopter operations *Providing electrical power services* Electrical hazards exposure (Item 8.7)	0.0036 (2,2,3)				
	TOTAL	0.007				
Recommendation 30 — Consider establishing on-duty time limits (such as those established for pilots) for helicopter crew members to reduce fatigue during helicopter operations.	**Helicopter operations** *Operating aircraft* Physical hazards exposure (Item 7.4)	0.0063 (2,3,3)				
	Helicopter operations *Operating aircraft* Electrical hazards exposure (Item 7.8)	0.0063 (2,2,4)				
	TOTAL	0.013				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 31 — Consider improving the technical support for cranes and davits such as sending personnel to maintenance classes and acquiring the current technical manuals, schematics, and operating instructions for the cranes and davits.	**Small boat launch/recovery** *Operating lifting equipment* Lifting equipment unavailable (Item 11.1)	0.333 (2,4,6)				
	Small boat launch/recovery *Operating lifting equipment* Loss of support (Item 11.2)	0.0333 (2,4,3)				
	TOTAL	0.37				
Recommendation 32 — Consider ways to simplify the electrical and mechanical system of the cranes and davits to improve the reliability of the systems.	**Small boat launch/recovery** *Operating lifting equipment* Lifting equipment unavailable (Item 11.1)	0.333 (2,4,6)				
	TOTAL	0.33				
Recommendation 33 — Consider periodically load testing the fiberglass around the lifting eyes on the small boats to determine if there is any degradation that can lead to a structural failure.	**Small boat launch/recovery** *Operating lifting equipment* Loss of support (Item 11.2)	0.0333 (2,4,3)				
	TOTAL	0.033				
Recommendation 34 — Consider requiring formal training for small boat equipment inspectors or using certified inspectors.	**Small boat launch/recovery** *Operating lifting equipment* Loss of support (Item 11.2)	0.0333 (2,4,3)				
	TOTAL	0.033				
Recommendation 35 — Consider weight testing the Motor Surf Boat (MSB) on a yearly basis to determine if the MSB is retaining water and increasing in weight.	**Small boat launch/recovery** *Operating lifting equipment* Loss of support (Item 11.2)	0.0333 (2,4,3)				
	TOTAL	0.033				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 36 — Consider re-engineering the control switch on the crane/davit for obvious forward and reverse operation.	**Small boat launch/recovery** *Operating lifting equipment* Incorrect load position/direction/speed (Item 11.3)	0.0333 (1,3,5)				
	TOTAL	0.033				
Recommendation 37 — Consider providing more hands-on launch and recovery operations training in nonemergency conditions.	**Small boat launch/recovery** *Operating lifting equipment* Physical hazards exposure (Item 11.4)	0.9 (4,5,6)				
	Small boat launch/recovery *Operating lifting equipment* Incorrect load position/direction/speed (Item 11.3)	0.0333 (1,3,5)				
	TOTAL	0.93				
Recommendation 38 — Consider maintaining the consistency of the personnel on the launch and recovery team to improve crew coordination.	**Small boat launch/recovery** *Operating vessels/craft* Incorrect position/direction/speed (Item 10.2)	0.36 (4,4,5)				
	Small boat launch/recovery *Operating lifting equipment* Physical hazards exposure (Item 11.4)	0.9 (4,5,6)				
	TOTAL	1.3				
Recommendation 39 — Consider installing a light on the weather deck that indicates whether the hydraulic pump is running.	**Small boat launch/recovery** *Operating lifting equipment* Fire/explosion (Item 11.6)	0.0063 (2,3,3)				
	TOTAL	0.006				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 40 — Consider establishing a consistent set of personnel on the boarding team to improve coordination between team members.	**Boarding** *Operating vessels/craft* Physical hazards exposure (Item 1.7)	0.36 (3,4,6)				
	Boarding *Providing assessment/investigation/ coordination services* Assessment/investigation/coordination quality problem (Item 3.2)	0.0333 (1,3,5)				
	Boarding *Providing assessment/investigation/ coordination services* Physical hazards exposure (Item 3.3)	3.006 (2,3,7)				
	Boarding *Providing assessment/investigation/ coordination services* Asphyxiant environment exposure (Item 3.6)	0.036 (2,3,5)				
	TOTAL	3.4				
Recommendation 41 — Consider including the coxswain in the boarding pre-brief to ensure that the coxswain is aware of the boarding plan.	**Boarding** *Operating vessels/craft* Incorrect position/direction/speed (Item 1.2)	0.036 (2,3,5)				
	Boarding *Operating vessels/craft* Vessel/craft fails to maintain position (Item 1.3)	0.036 (2,3,5)				
	Small boat launch/recovery *Operating vessels/craft* Incorrect position/direction/speed (Item 10.2)	0.36 (4,4,5)				
	TOTAL	0.43				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 42 — Consider having the coxswain get a bridge-eye view of the transit path and subject vessel before the boarding evolution.	**Boarding** *Operating vessels/craft* Incorrect position/direction/speed (Item 1.2)	0.036 (2,3,5)				
	Boarding *Operating vessels/craft* Vessel/craft fails to maintain position (Item 1.3)	0.036 (2,3,5)				
	TOTAL	0.07				
Recommendation 43 — Consider providing the boarding team with brighter flashlights to improve night boarding visibility and visibility in dark vessel spaces (e.g., state-of-the-art lights).	**Boarding** *Operating vessels/craft* Physical hazards exposure (Item 1.7)	0.36 (3,4,6)				
	Boarding *Providing assessment/investigation/ coordination services* Assessment/investigation/coordination quality problem (Item 3.2)	0.0333 (1,3,5)				
	Boarding *Providing assessment/investigation/ coordination services* Physical hazards exposure (Item 3.3)	3.006 (2,3,7)				
	TOTAL	3.4				
Recommendation 44 — Consider rotating boarding team members during high temperature evolutions to reduce fatigue and heat exhaustion.	**Boarding** *Operating vessels/craft* Hot/cold environments exposure (Item 1.17)	0.3006 (1,2,6)				
	TOTAL	0.3				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 45 — Consider ensuring that boarding teams carry plenty of water during high temperature operations.	Boarding *Operating vessels/craft* Hot/cold environments exposure (Item 1.17)	0.3006 (1,2,6)				
	TOTAL	0.3				
Recommendation 46 — Consider having boarding teams carry hearing protection and use the protection when inspecting high noise areas on the subject vessels (e.g., engine room, compressor, or generator spaces).	Boarding *Providing assessment/investigation/ coordination services* High noise exposure (Item 3.9)	Screened				
	TOTAL	—				
Recommendation 47 — Consider requiring all boarding team members to be inoculated before performing boardings (e.g., hepatitis A and B, gamma globulin).	Boarding *Providing assessment/investigation/ coordination services* Biological hazards exposure (Item 3.12)	0.3033 (4,3,3)				
	TOTAL	0.3				
Recommendation 48 — Consider implementing safety function (operational) checks of small arms weapons before each boarding.	Boarding *Small caliber weapons and other weapons* Inoperable weapons (Item 2.1)	Screened				
	Boarding *Small caliber weapons and other weapons* Inadvertent firing (Item 2.2)	0.009 (2,3,4)				
	TOTAL	0.009				
Recommendation 49 — Consider having the boarding team collectively load and unload small caliber weapons.	Boarding *Small caliber weapons and other weapons* Inadvertent firing (Item 2.2)	0.009 (2,3,4)				
	TOTAL	0.009				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 50 *— Consider using wireless communication equipment for the landing safety officer (LSO), pilot, helicopter control officer (HCO), and helicopter team to improve communications.*	**Helicopter operations** *Operating aircraft* High noise exposure (Item 7.10)	0.063 (2,4,5)				
	TOTAL	0.063				
Recommendation 51 *— Consider screening venders that have previously supplied contaminated/low quality fuel oil.*	**Helicopter operations** *Providing fuel services* Fuel quality problem (Item 9.2)	0.09 (3,4,5)				
	TOTAL	0.09				
Recommendation 52 *— Consider improving eye and face protection when refueling the helicopter, such as adding a face shield to helmets.*	**Helicopter operations** *Providing fuel services* Toxic/corrosive/reactive materials exposure (Item 9.4)	0.036 (2,3,5)				
	TOTAL	0.036				
Recommendation 53 *— Consider changing the type of gloves worn by the fueling team to rubber gloves to protect the crew from the fuel oil.*	**Helicopter operations** *Providing fuel services* Toxic/corrosive/reactive materials exposure (Item 9.4)	0.036 (2,3,5)				
	TOTAL	0.036				
Recommendation 54 *— Consider ensuring that load tests are performed on chain falls and that preventive maintenance on the chain falls is working.*	**Not operation/evolution specific** *Operating lifting equipment* Loss of support (Item 19.2)	0.306 (2,3,6)				
	TOTAL	0.30				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 55 — Consider updating the supplies and materials required to be warehoused on the cutter to reflect the current cutter requirements.	**Not operation/evolution specific** *Providing warehousing services* Physical hazards exposure (Item 25.3)	0.036 (2,3,5)				
	Not operation/evolution specific *Providing warehousing services* Fire/explosion (Item 25.5)	0.00603 (2,3,2)				
	Not operation/evolution specific *Providing warehousing services* Toxic/corrosive/reactive materials exposure (Item 25.4)	0.036 (2,3,5)				
	TOTAL	0.078				
Recommendation 56 — Consider coding all gauges and other equipment so "in" parameter and "out of" parameter readings or conditions can be identified quickly by watchstanders.	**Not operation/evolution specific** *Providing assessment/investigation/ coordination services* Assessment/investigation/coordination quality problem (Item 26.2)	0.063 (2,4,5)				
	TOTAL	0.063				
Recommendation 57 — Consider eliminating watchstanders during the work day and placing the responsibility for checking equipment or spaces on vessel personnel working with the equipment or working in the spaces.	**Not operation/evolution specific** *Providing assessment/investigation/ coordination services* Assessment/investigation/coordination quality problem (Item 26.2)	0.063 (2,4,5)				
	TOTAL	0.063				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for WMEC-210 (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Recommendation 58 — Consider installing cameras to watch the exterior parts of the vessel to reduce the number of watchstanders currently required.	**Not operation/evolution specific** *Providing assessment/investigation/ coordination services* Assessment/investigation/coordination quality problem (Item 26.2)	0.063 (2,4,5)				
	TOTAL	0.063				
Recommendation 59 — Consider moving the breaker for each individual electrical panel closer to the location of the panel.	**Not operation/evolution specific** *Providing electrical power services* Electrical hazards exposure (Item 23.7)	0.63 (3,5,6)				
	TOTAL	0.63				
Recommendation 60 — Consider using ground fault circuit interrupters (GFCI) on all power cords used on the exterior of the vessel.	**Not operation/evolution specific** *Providing/maintaining structures* Electrical hazards exposure (Item 20.8)	0.036 (2,3,5)				
	TOTAL	0.036				

Table B.2 Worksheet for Establishing the Risk Reduction of Recommendations Applicable to High Risk Deviations

Deviation	Associated Recommendation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Boarding *Providing assessment/ investigation/ coordination services* Physical hazards exposure (Item 3.3)	*Recommendation 40 — Consider establishing a consistent set of personnel on the boarding team to improve coordination between team members.* *Recommendation 43 — Consider providing the boarding team with brighter flashlights to improve night boarding visibility and visibility in dark vessel spaces (e.g., state-of-the-art lights).*	3.006 (2,3,7)				
Small boat launch/recovery *Operating lifting equipment* Physical hazards exposure (Item 11.4)	*Recommendation 37 — Consider providing more hands-on launch and recovery operations training in nonemergency conditions.* *Recommendation 38 — Consider maintaining the consistency of the personnel on the launch and recovery team to improve crew coordination.*	0.9 (4,5,6)				
Not operation/evolution specific *Providing electrical power services* Electrical hazards exposure (Item 23.7)	*Recommendation 59 — Consider moving the breaker for each individual electrical panel closer to the location of the panel.*	0.63 (3,5,6)				
Helicopter operations *Operating aircraft* Aircraft unavailable (Item 7.1)	—	0.63 (3,5,6)				

Table B.2 Worksheet for Establishing the Risk Reduction of Recommendations Applicable to High Risk Deviations (cont'd)

Deviation	Associated Recommendation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Vessel leaving or returning *Operating vessels/craft* Incorrect position/ direction/speed (Item 16.2)	*Recommendation 2 — Consider mandating the use of tugs/pusher boats in mooring/unmooring operations.*	0.63 (4,4,6)				
	Recommendation 6 — Consider promoting the use of local ship-driving simulators for training vessel personnel.					
Not operation/evolution specific *Providing industrial systems/equipment* Physical hazards exposure (Item 21.3)	—	0.6003 (1,5,6)				
Damage control — fire *Providing fire services* Physical hazards exposure (Item 4.3)	*Recommendation 7 — Consider performing additional walkthrough evolutions for damage control with only a limited amount of equipment before conducting walkthrough evolutions with full damage control equipment.*	0.603 (2,5,6)				
	Recommendation 8 — Consider medically screening for claustrophobia those vessel personnel assigned to damage control duties.					
	Recommendation 9 — Consider additional damage control cross-training for vessel personnel.					
	Recommendation 10 — Consider using local firefighting training facilities for training vessel personnel in damage control events.					
	Recommendation 11 — Consider promoting shipboard familiarization visits by local fire departments.					

Table B.2 Worksheet for Establishing the Risk Reduction of Recommendations Applicable to High Risk Deviations (cont'd)

Deviation	Associated Recommendation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (lower/upper)
Damage control — fire *Providing fire services* Physical hazards exposure (Item 4.3)	*Recommendation 13 — Consider developing Tailored Shipboard Training Assessment (TSTA) damage control scenarios that require numbers of personnel more in line with expected vessel manning.*					
	Recommendation 14 — Consider using portable AFFF extinguishers on board vessels.					
	Recommendation 17 — Once new personnel are identified for sea duty, consider sending them to some type of damage control training before arriving at a vessel.					
	Recommendation 20 — Consider using thermal imager and O_2 sampler mock-ups instead of actual equipment during damage control drills.					
	Recommendation 21 — Consider not grading TSTA or underway drills.					

Attachment C

Coarse Hazard Analysis of the Integrated Support Command (ISC) at Seattle, Washington

This attachment contains the results of a coarse hazard analysis performed on a Coast Guard shore facility. Included are typical results produced by the analysis and the raw data collected during the analysis sessions with the subject matter experts.

COARSE HAZARD ANALYSIS OF THE INTEGRATED SUPPORT COMMAND (ISC) AT SEATTLE, WASHINGTON

A Product of the United States Coast Guard Research and Development Center

Prepared by
JBF Associates, Inc.

October 1997

This work was performed by JBF Associates, Inc. (JBFA-101-05-07.1-94) for the United States Coast Guard under Delivery Order DTCG39-97-F-E00128 of Contract Number DTCG39-95-F-E00395.

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ABSTRACT

This report documents a coarse hazard analysis of the United States Coast Guard (USCG) Integrated Support Command (ISC) in Seattle, Washington. The analysis was performed using the Integrated Safety Assessment (ISA) coarse hazard analysis methodology. Personnel from JBF Associates, Inc. performed the analysis. Personnel from (1) the Research and Development Center, (2) the office of Facility Safety, and (3) the office of Logistics Policy provided oversight. Both USCG and civilian personnel at ISC Seattle served as subject matter experts for the analysis.

The coarse hazard analysis provides (1) quantitative risk results for ISC operations and (2) recommendations for reducing risk (58 risk reduction recommendations were generated). The analysis focused on pier services, industrial services, and base services. Off-base activities and small boat operations (and the associated risks) were not addressed.

SUMMARY

This report presents the results of a coarse hazard analysis for a United States Coast Guard (USCG) Integrated Support Command (ISC) using the Integrated Safety Assessment (ISA) coarse hazard analysis methodology. The analysis was performed for the ISC in Seattle, Washington. Personnel from JBF Associates, Inc. facilitated the analysis. The purpose of the analysis was to test the ISA process on a USCG shore facility and to identify dominant risk contributors for ISC Seattle's operations. The analysis focused on pier services, industrial services, and base services. Off-base activities and small boat operations (and the associated risks) were not addressed.

The analysis covered a majority of the operations/evolutions and functions applicable to an ISC and produced 58 risk reduction recommendations specific to ISC Seattle. The amount of risk reduction attributed to each recommendation was not assessed in this analysis.

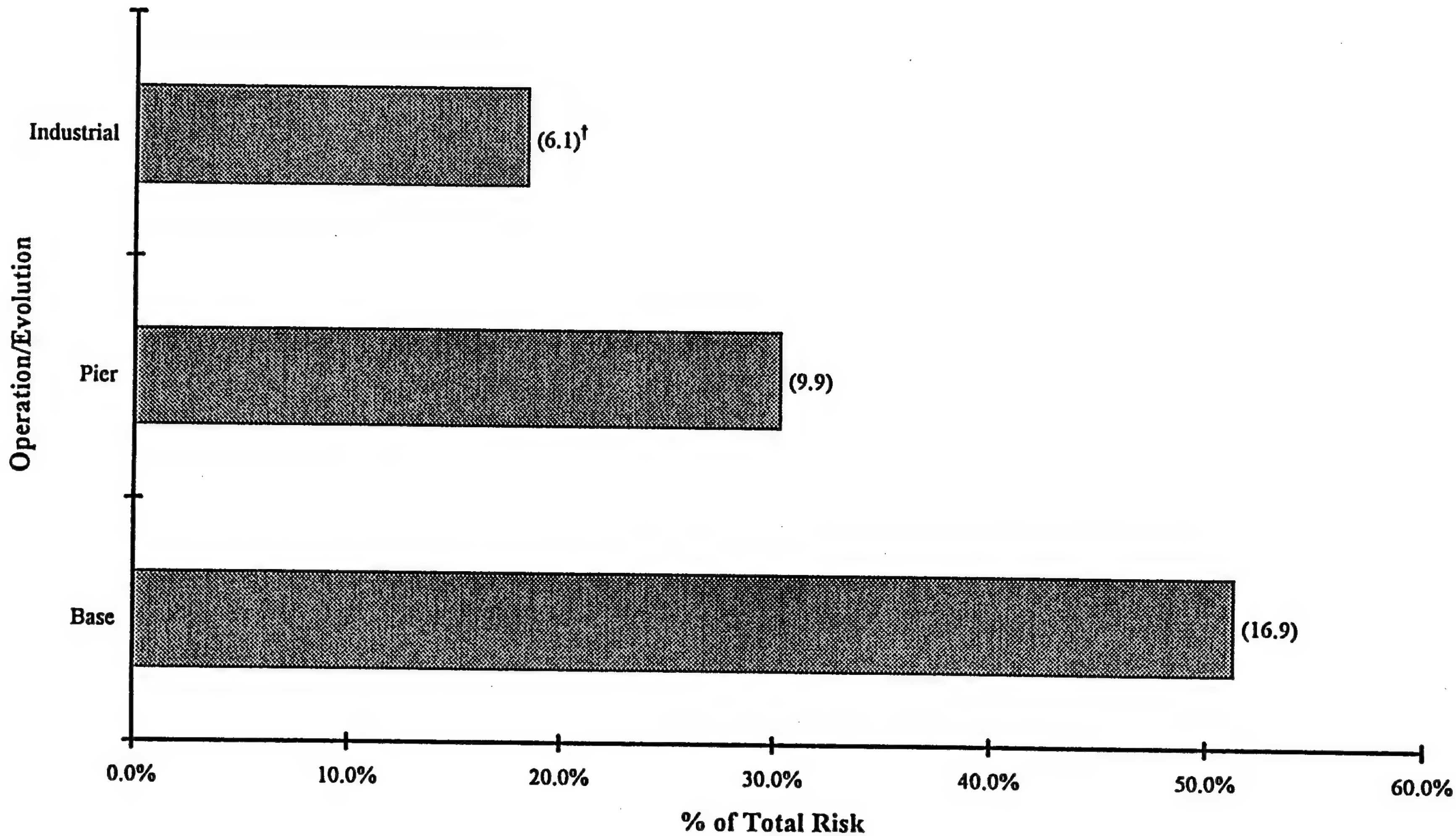
The total facility risk index number (RIN) for ISC Seattle is 32.9. (An RIN of 1 is equivalent to $10,000 of potential loss due to risk.) The RIN translates into the mishap class frequencies presented in Table S.1.

Table S.1 Overall Evaluation Results for ISC Seattle

	Frequency Bounds for Mishaps (per year)			Expected Number of Occurrences over 50 Years		
Unit	**A/B**	**C**	**D**	**A/B**	**C**	**D**
ISC Seattle	0.1 to 1	3 to 31	69 to 694	~5 to ~50	~150 to ~1,550	~3,500 to ~35,000

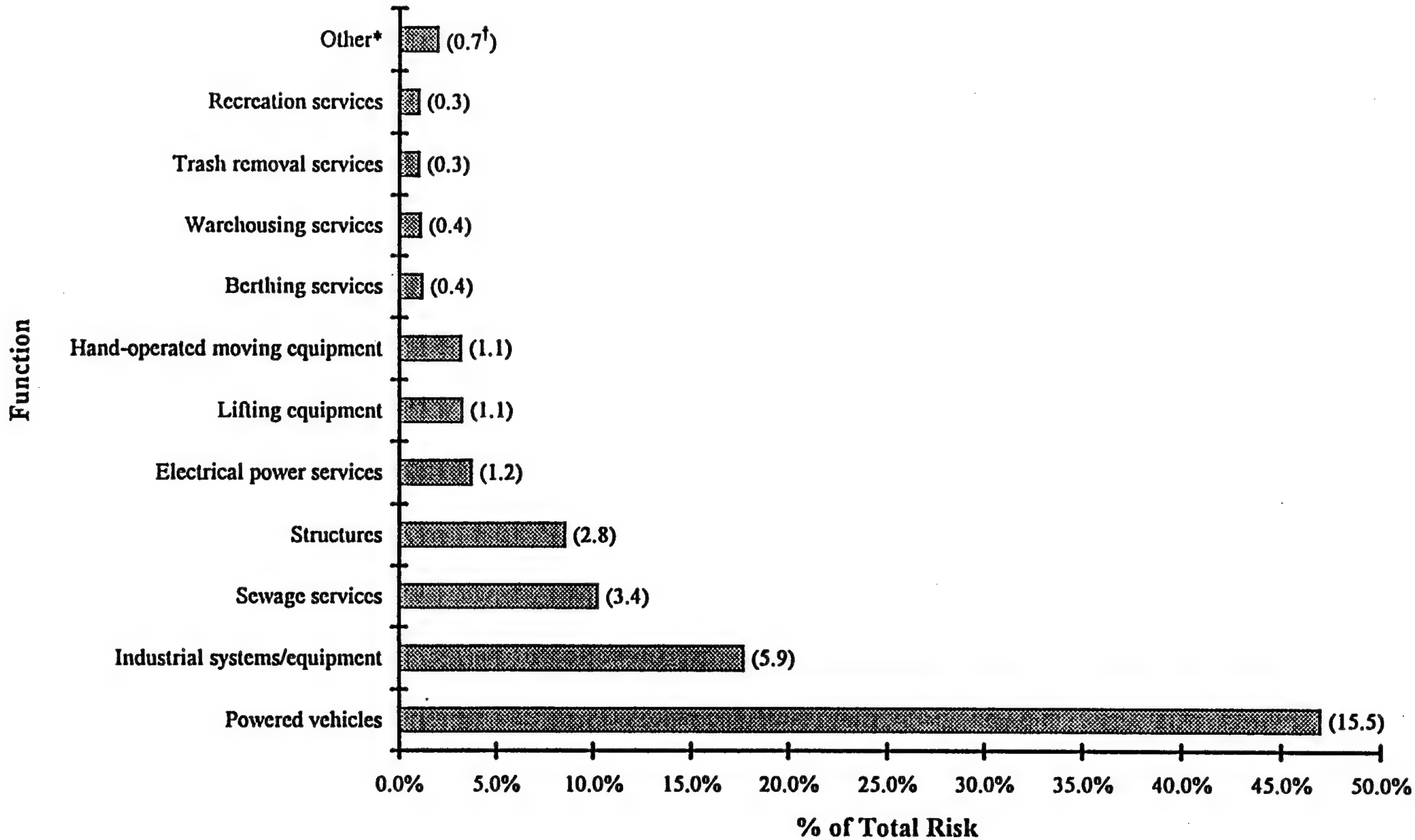
The mishap categories (Class A, B, C, and D) in Table S.1 are consistent with the health and safety categories defined by the USCG. In addition, these categories have been expanded to include economic, mission, and environmental impacts.

The following figures present risk information by operation/evolution, function, and location.



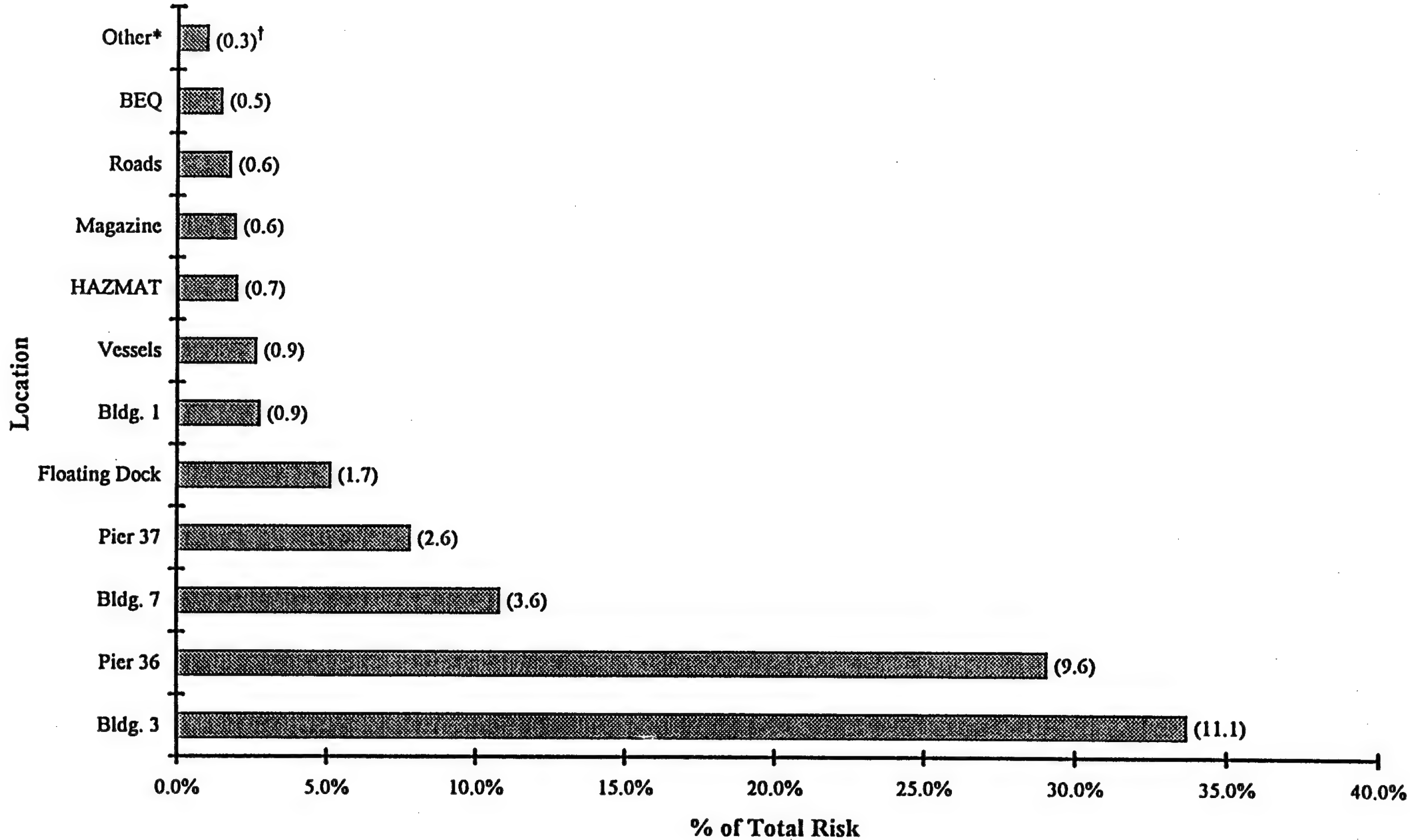
†Risk Index Number

Figure S.1 Risk Contribution of Operations/Evolutions — ISC Seattle



†Risk Index Number
*"Other" contains lower risk functions. The following functions are included: HVAC, administrative, potable water, compressed gas, drainage, fueling, security, small caliber/other weapons, and compressed air.

Figure S.2 Risk Contribution of Functions — ISC Seattle



†Risk Index Number
*"Other" contains lower risk locations. The following locations are included: firing range, armory, and Bldg. 2.

Figure S.3 Risk Contribution of Locations — ISC Seattle

1. INTRODUCTION

This report presents the results of a coarse hazard analysis of a United States Coast Guard (USCG) shore facility using the Integrated Safety Assessment (ISA) coarse hazard analysis methodology[1]. The analysis was performed for the Integrated Support Command (ISC) in Seattle, Washington. Personnel from JBF Associates, Inc. (JBFA) performed the analysis. Personnel from (1) the Research and Development Center (RDC), (2) the office of Facility Safety (G-WKS-2), and (3) the office of Logistics Policy (G-SLP) provided oversight. Both USCG and civilian personnel at ISC Seattle served as subject matter experts for the analysis. Table 1 lists the personnel involved in the analysis.

Table 1 Coarse Hazard Analysis Team Members

Individual	Organization	Responsibility
Vernon H. Guthrie	JBF Associates, Inc.	Analysis leader
David A. Walker	JBF Associates, Inc.	Analysis leader
Thomas F. Zanin	JBF Associates, Inc.	Documentation
Andrew M. Huff	JBF Associates, Inc.	Documentation
William H. Jones	RDC	Oversight
Bennie L. Smith (Jr)	G-WKS-2	Oversight
LT Stephen Dakin	G-SLP	Oversight
Gerald Hansmire	Makers Architecture Company	Subject matter expert
ISC Seattle and Naval Engineering Support Unit (NESU) Seattle Staff	ISC and NESU Seattle	Subject matter experts

The course hazard analysis provides (1) quantitative risk results for ISC operations and (2) recommendations for reducing risk (58 risk reduction recommendations were generated). The analysis focused on pier services, industrial services, and base services. Off-base activities and small boat operations (and the associated risks) were not addressed.

2. *RISK INFORMATION CONTAINED IN THE REPORT*

Table 2 presents the types of risk information included in this report.

Table 2 Types of Risk Information *(A check signifies the information is included in this report)*

	Risk Matrix	Most Significant Deviations	Overall Results (Frequency Bounds)	Comparison of Results with MISREP Data
Facility Risk	✓*	✓*	✓*	✓*

	Bar Chart	By Operation/ Evolution	By Function	By Location	By Deviation Type
Operation/Evolution	✓*				
Functions	✓*				
Locations	✓*		✓*		
Deviation Types	✓*		✓*		

	Listing of Recommendations	Estimated Risk Impact of Recommendations Versus Deviations	Estimated Risk Impact of Deviations Versus Recommendations
Recommendations	✓*	✓*	

* Standard risk information included in every ISA coarse hazard analysis report.

3. *UNIT AND OPERATIONS*

ISC Seattle provides equipment, maintenance, and personnel support to vessels stationed in and visiting Seattle, as well as commands resident on base. High endurance cutters (WHECs) and polar ice breaker cutters are normally stationed at ISC Seattle. Vessel maintenance support comes from a Naval Engineering Support Unit (NESU) and an Electronic Support Unit (ESU) located on base. ISC facilities are maintained by a facility engineering staff with shops separate from NESU and ESU.

4. *SCOPE OF THE COARSE HAZARD ANALYSIS*

The team analyzed activities at ISC Seattle but did not analyze activities for all ISCs. Table 3 presents the operations/evolutions and functions addressed by the coarse hazard analysis team (denoted by shaded cells). The functions applicable to operations/evolutions are denoted by the checks in Table 3.

4.1 ANALYSIS EXCEPTIONS

4.1.1 Exceptions for Operations/Evolutions

- The small boat station was not analyzed (the analysis focused on ISC activities).

- Off-base mishaps were not evaluated during the analysis.

4.1.2 Exceptions for Functions

Because of time constraints, not all functions for each evaluated operation/evolution were addressed by the hazard analysis team. However, all ISC functions identified as the most significant for the facility's risk were evaluated.

Table 3 Operations/Evolutions and Functions Matrix — ISC Seattle

FUNCTION GROUPS	MAJOR FUNCTIONS	ISC OPERATIONS/EVOLUTIONS			
		Pier Services †	Industrial Services ‡	Base Services ■	Off-base Activities
Operating Vessels, Vehicles, Aircraft, or Equipment	Vessels/craft (N/A to ISCs)				✓
	Powered vehicles (trucks, cars, mobile cranes, forklifts, etc.)	✓	✓	✓	✓
	Hand-operated moving equipment (dollies, carts, etc.)	✓	✓	✓	✓
	Lifting equipment	✓	✓	✓	✓
	Aircraft (ground operations)			✓	✓
Operating/Maintaining Structures	Structures (buildings, piers, vessels, craft, etc.)	✓	✓	✓	✓
Providing Services/Utilities	Industrial systems/equipment	✓	✓	✓	✓
	Large caliber weapons	✓		✓	
	Small caliber weapons and other weapons	✓		✓	✓

Table 3 Operations/Evolutions and Functions Matrix — ISC Seattle (cont'd)

FUNCTION GROUPS	MAJOR FUNCTIONS	ISC OPERATIONS/EVOLUTIONS			
		Pier Services †	Industrial Services ‡	Base Services ■	Off-base Activities
Providing Services/Utilities (cont'd)	Electrical power services	✓	✓	✓	✓
	Fueling services	✓	✓	✓	✓
	Potable water services	✓	✓	✓	✓
	Drainage services	✓	✓	✓	✓
	Heating, ventilating, air conditioning services		✓	✓	✓
	Trash removal services	✓	✓	✓	✓
	Compressed air services	✓	✓	✓	✓
	Compressed gas services	✓	✓	✓	✓
	Sewage services	✓	✓	✓	✓
	Food services			✓	✓
	Berthing services			✓	✓

Table 3 Operations/Evolutions and Functions Matrix — ISC Seattle (cont'd)

FUNCTION GROUPS	MAJOR FUNCTIONS	ISC OPERATIONS/EVOLUTIONS			
		Pier Services †	Industrial Services ‡	Base Services ■	Off-base Activities
Providing Services/Utilities (cont'd)	Steam services	✓	✓	✓	✓
	Medical services			✓	✓
	Recreation services			✓	✓
	Administrative services		✓	✓	✓
	Inspection services (N/A to ISCs)				
	Warehousing services		✓		✓
	Fire services			✓	✓
	Security services			✓	✓

† Pier services include Pier 35, Pier 36, Pier 37 (including the apron), and the small boat piers

‡ Industrial services include Building 7 (areas under USCG control), Building 3 (NESU), outdoor storage (HAZMAT storage), ATON support building, and warehouse storag buildings

■ Base services include the BEQ/Galley, Barber Shop, Armory, Building 7 (firing range), Magazine, Boathouse, Administrative Building, Exchange, Building 3 (facilit engineering and the recreation center), and Museum

5. *ANALYSIS APPROACH*

The ISC Seattle coarse hazard analysis was performed using the guidance of Reference 1. Detailed worksheets documenting the coarse hazard analysis are presented in Attachment A. These worksheets are organized by operation/evolution and describe how deviations (upset conditions) lead to mishaps (i.e., the deviation causes, safeguards, and mishaps of interest). The risk index numbers (RINs) characterizing the risk associated with each deviation are also listed in each worksheet. Reference 1 discusses the mishap categories and frequency categories listed in the Attachment A worksheets. The frequency categories are also shown in Figure 1. The mishap categories (Class A, B, C, and D mishaps) for health and safety losses are defined in the USCG Safety and Environmental Health Manual[2]. The mishap categories have been expanded to include economic, mission, and environmental losses and are summarized in Table 4.

Frequency Scoring Categories

Frequency Score Descriptions	Frequency Scores (with indicated frequency bounds)	Example Benchmarks for Assigning Categories for a Single Vessel
Continuous Will occur almost continously (100 or more times per year)	8	
	100/y	
Very Frequent Will occur very frequently (10 to 100 times per year)	7	One event each week One event each month
	10/y	
Frequent Will occur frequently (one to 10 times per year)	6	One event each quarter
	1/y	One event per year
Occasional Will occur periodically (one time every 1 to 10 years)	5	One event over one tour (3 years)
	0.1/y	One event over three tours (9 years)
Probable Will occur a few times over a 50-year period (one time every 10 years to 50% chance over a 50-year period)	4	10% chance of an event over one tour (3 years)
	$1x10^{-2}/y$	10% chance of an event over three tours (9 years)
Improbable Unlikely, but reasonably expected to occur (50% to 5% chance over a 50-year period)	3	1% chance of an event over one tour (3 years)
	$1x10^{-3}/y$	1% chance of an event over three tours (9 years)
Rare Very unlikely, but credible (5% to 0.5% chance over a 50-year period)	2	1-in-1,000 chance of an event over one tour (3 years)
	$1x10^{-4}/y$	1-in-1,000 chance of an event over three tours (9 years)
Remote Extremely unlikely, but not physically impossible (0.5% to 0.005% chance over a 50-year period)	1	
	$1 \times 10^{-5}/y$	~1-in-10,000 chance of an event over three tours (9 years)
Incredible Physically impossible or virtually impossible (less than 0.005% chance over a 50-year period)	0	~1-in-100,000 chance of an event over three tours (9 years)

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Figure 1 Frequency Scoring Categories

Table 4 Mishap Categories

Mishap Category	Safety	Economic	Mission	Environmental
Class A	A vessel is missing or abandoned, recovery is impossible or impractical, or the vessel cannot be repaired economically; an injury or illness results in a fatality or permanent total disability	The cost of reportable property damage is $1,000,000 or greater	Major impact on ability of vessel/base to rapidly accomplish critical missions. Significant command attention	Major offsite impact (offsite health effects)
Class B	Any injury or illness results in permanent partial disability; five or more people are inpatient hospitalized	The cost of reportable property damage is $200,000 or more, but less than $1,000,000		
Class C	A nonfatal injury or illness results in loss of time from work beyond the day or shift on which it occurred	The cost of property damage is $10,000 or more, but less than $200,000	Moderate impact on ability of vessel/base to rapidly accomplish critical missions. Limited capabilities, but able to respond if needed	Significant offsite impact (community alert or awareness)
Class D	A nonfatal injury or illness occurs that does not meet the criteria of a Class C mishap; a person is overboard, an accidental firearms discharge occurs, or an electric shock occurs, none of which meets the criteria of a higher classification	The cost of property damage is less than $10,000	Minor impact on ability of vessel/base to rapidly accomplish critical missions. Operational nuisance	Onsite release of a substance with minor/no offsite effects

6. RESULTS

6.1 FACILITY RISK

6.1.1 Risk Matrix

The risk matrix for ISC Seattle is shown in Figure 2. The shaded areas in Figure 2 represent risk categories below the screening criteria (very low risk). Not all deviations addressed by the analysis team are reflected in Figure 2 because the team screened certain deviations from further study during the analysis (screening is described in Reference 1). The number in each cell of the matrix is the number of deviations with the frequency score and mishap class represented by the cell.

	Class D Mishaps	Class C Mishaps	Class A/B Mishaps
Continuous (8)	—	—	—
Very Frequent (7)	5	—	—
Frequent (6)	15	1	—
Occasional (5)	44	18	—
Probable (4)		27	8
Improbable (3)			9
Rare (2)			30
Remote (1)			
Incredible (0)			

Figure 2 Risk Matrix for ISC Seattle

6.1.2 High Risk Deviations

Table 5 presents a list of the high risk deviations for ISC Seattle as indicated by their associated risk index numbers (RINs) (i.e., those with RINs greater than 3.0).

Table 5 High Risk Deviations† for ISC Seattle

RIN (Risk Contribution)	Deviation*	Operation/ Evolution	Function	Dominant Location
3.33 (10.1%)	Incorrect position, direction, power/speed (Item 25.2)	Pier Services	Operating powered vehicles	Pier 36
3.33 (10.1%)	Contact with/struck against (Item 25.19)	Pier Services	Operating powered vehicles	Pier 36
3.33 (10.1%)	Incorrect position, direction, power/speed (Item 20.2)	Industrial Services	Operating powered vehicles	Bldg. 7
3.33 (10.1%)	Incorrect position, direction, power/speed (Item 10.2)	Base Services	Operating powered vehicles	Bldg. 3
3.3 (10%)	Inadequate/no sewage service (Item 30.1)	Pier Services	Providing sewage services	Pier 36, Pier 37, Floating Dock
3.03 (9.2%)	System/equipment unavailable (Item 5.1)	Base Services	Operating industrial systems/equipment	Bldg. 3

† The remaining deviations had risk contributions less than 2.0% of total facility risk.

* The referenced item numbers in Table A.1 discuss the specific causes (including equipment failures, human errors, and external events), mishaps, and safeguards associated with these deviations.

6.1.3 Overall Frequency Bounds for Mishaps

Table 6 summarizes the frequency bounds for Class A/B, Class C, and Class D mishaps at ISC Seattle. This information indicates the expected frequency ranges in which mishaps will occur for each mishap class. The mishap frequency bounds were determined using the information from Figure 2 and the upper and lower frequency bounds for each mishap frequency category (see Reference 1).

Table 6 Overall Evaluation Results for ISC Seattle

Unit	Frequency Bounds for Mishaps (per year)			Expected Number of Occurrences over 50 Years		
	A/B	C	D	A/B	C	D
ISC Seattle	0.1 to 1	3 to 31	69 to 694	~5 to ~50	~150 to ~1,550	~3,500 to ~35,000

6.1.4 Comparison of Analysis Results with Mishap Reporting (MISREP) Data

Table 7 compares the estimated frequency bounds for mishaps associated with ISC Seattle to actual mishap frequencies based on mishap reporting data (MISREP data) from the last 5 years. A MISREP database search was performed for ISC Seattle and major tenant commands.

Table 7 Comparison of Estimated Mishap Frequencies for ISC Seattle Vessel Class with Mishap Reporting Data

Unit	Estimated Frequency Bounds for Mishaps (per year)			Mishap Frequencies Based on USCG (MISREP) Data (per year)[1]		
	A/B	C	D	A/B[2]	C[3]	D[4]
ISC Seattle	0.1 to 1	3 to 31	69 to 694	None reported (<0.2/yr)	~3	~4

[1] MISREP search was conducted for ISC Seattle and major tenant commands.
[2] Based on 0 Class A/B mishaps over 5 years (assumed <1 mishap/5 years).
[3] Based on 13 Class C mishaps over 5 years (13 mishaps/5 years).
[4] Based on 22 Class D mishaps over 5 years (22 mishaps/5 years).

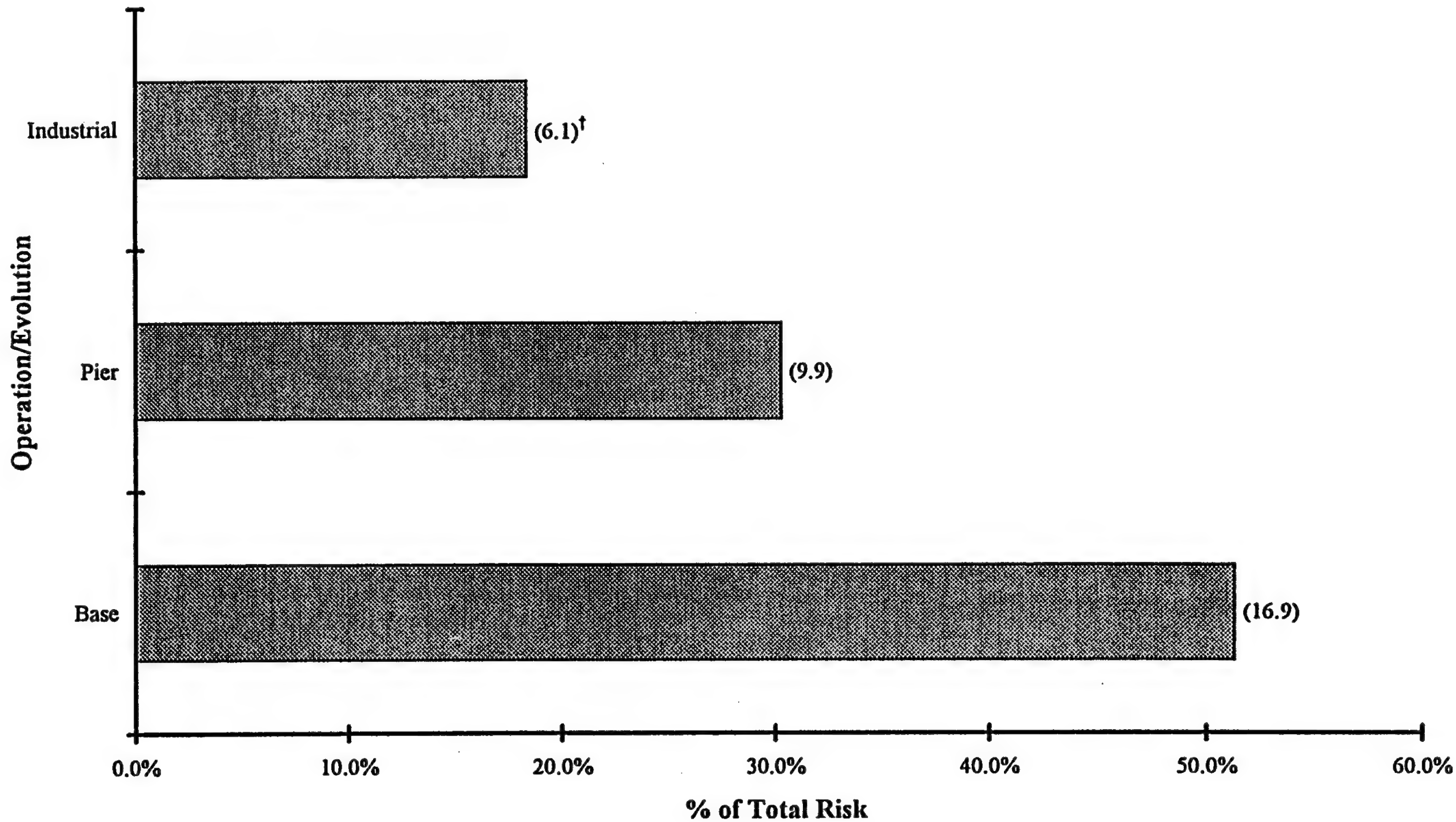
6.2 RESULTS FOR SELECTED RISK INFORMATION TYPES

This section presents results for the risk information types selected in Table 2. The coarse hazard analysis recommendations are presented in Section 8.

The following figures and tables provide specific risk information:

Figure or Table	Description
Figure 3 — Risk Contribution of Operations/Evolutions	Bar chart of the risk contributions
Table 8 — High Risk Operations/Evolutions	List of operations/evolutions contributing to ~80% of facility risk and the deviations that contribute to ~80% of the operation/evolution risk
Figure 4 — Risk Contribution of Functions	Bar chart of the risk contributions
Table 9 — High Risk Functions	List of functions contributing to ~80% of facility risk and the deviations that contribute to ~80% of the function risk
Figure 5 — Risk Contribution of Locations	Bar chart of the risk contributions

Figure or Table	Description
Table 10 — High Risk Locations	List of locations contributing to ~80% of facility risk and the deviations that contribute to ~80% of the location risk
Figure 6 — Risk Contribution of Deviation Types	Bar chart of the risk contributions
Table 11 — High Risk Deviation Types	List of deviation types contributing to ~80% of facility risk and the deviations that contribute to ~80% of the deviation type risk
Table 12 — Risk Contribution of Locations by Function	Matrix of risk contribution (location vs. function)
Table 13 — Risk Contribution of Deviation Types by Function	Matrix of risk contribution (deviation type vs. function)



†Risk Index Number

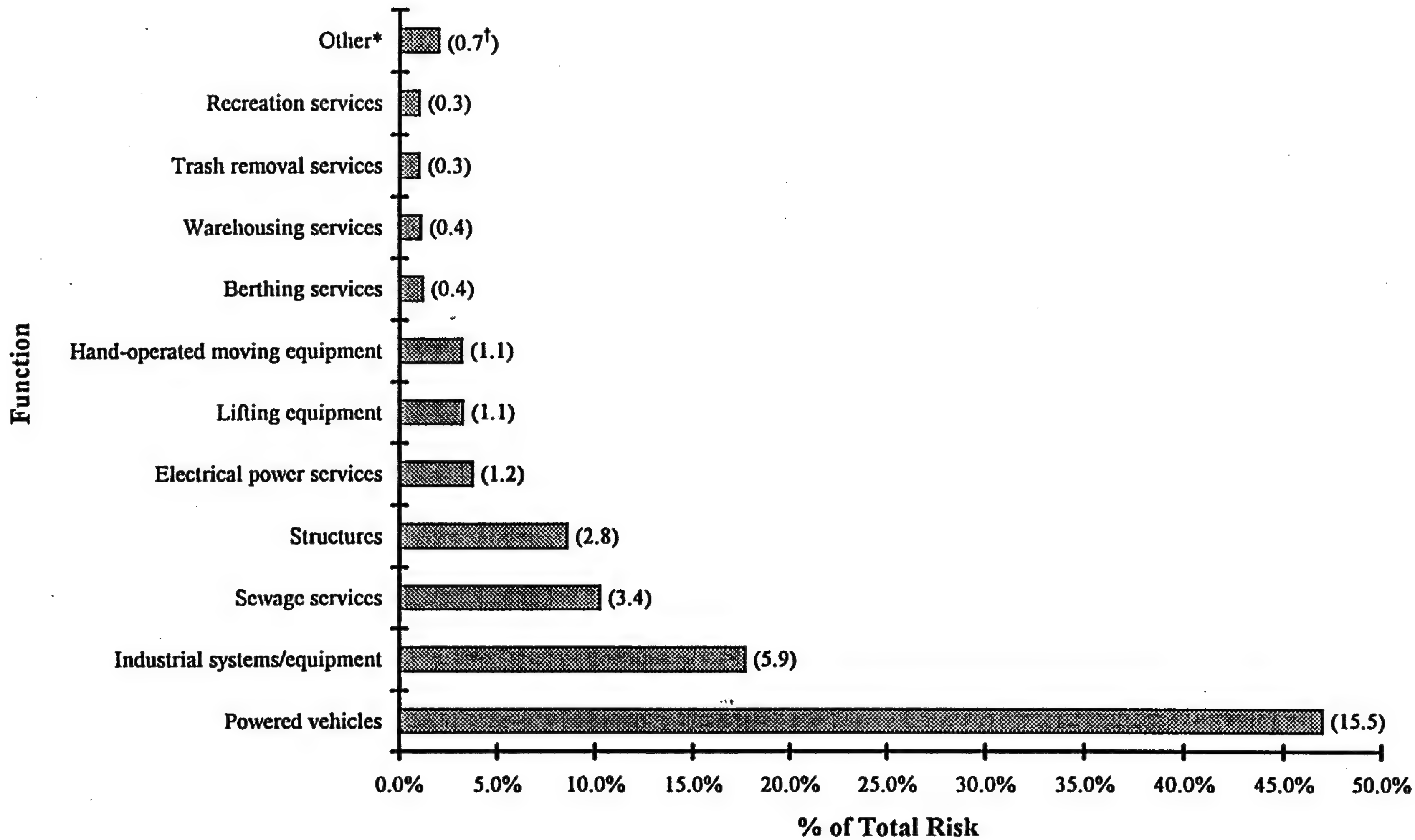
Figure 3 Risk Contribution of Operations/Evolutions — ISC Seattle

Table 8 High Risk Operations/Evolutions

Operations/Evolutions Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Operation/Evolution Risk		Deviation Risk Contribution to Operation/Evolution
		Deviation	Function	
Base Services	51.3%	Incorrect position, direction, speed	Operating powered vehicles	19.7%
		Inadequate/no sewage services	Providing sewage services	19.5%
		System/equipment unavailable	Providing industrial systems/equipment	17.9%
		Excessive dynamic structural loading	Operating/maintaining structures	3.7%
		Strain	Providing industrial systems/equipment	3.7%
		Poor quality products, services, or operations	Providing industrial systems/equipment	3.6%
		Poor quality products, services, or operations	Providing electrical power services	3.6%
		System/equipment unavailable	Providing electrical power services	3.6%
		Strain	Operating hand-operated moving equipment	2.1%
		Structural degradation	Operating/maintaining structures	1.9%
		Slip, trip, fall	Providing industrial systems/equipment	1.9%

Table 8 High Risk Operations/Evolutions (cont'd)

Operations/Evolutions Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Operation/Evolution Risk		Deviation Risk Contribution to Operation/Evolution
		Deviation	Function	
Pier Services	30.3%	Incorrect position, direction, speed	Operating powered vehicles	33.4%
		Contact with/struck against	Operating powered vehicles	33.4%
		Excessive static structural loading	Operating/maintaining structures	6.3%
		Vehicle fails to maintain position	Operating powered vehicles	3.6%
		Struck by/contact by	Operating powered vehicles	3.3%

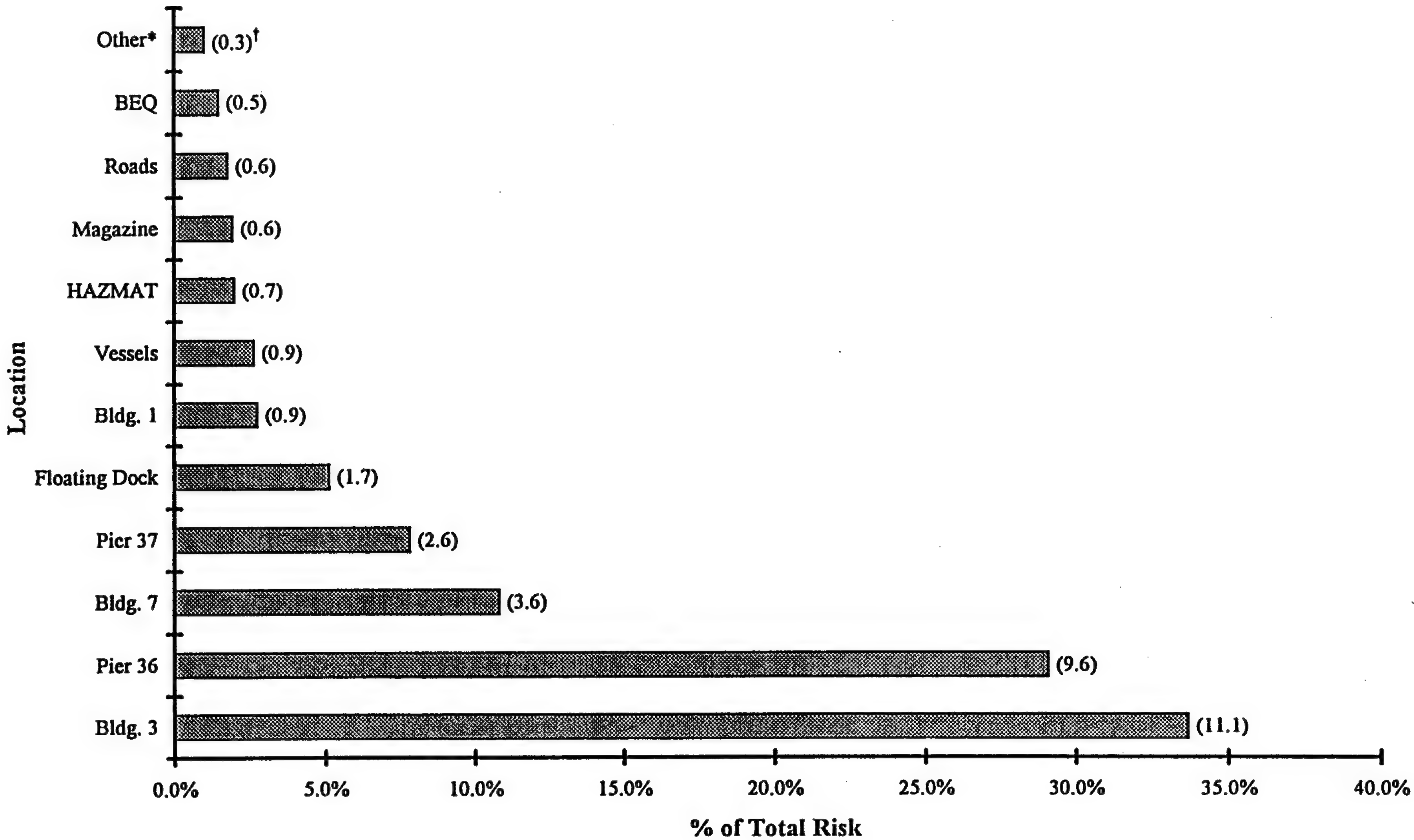


†Risk Index Number
*"Other" contains lower risk functions. The following functions are included: HVAC, administrative, potable water, compressed gas, drainage, fueling, security, small caliber/other weapons, and compressed air.

Figure 4 Risk Contribution of Functions — ISC Seattle

Table 9 High Risk Functions

Functions Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Function Risk		Deviation Risk Contribution to Function
		Deviation	Operation/Evolution	
Operating powered vehicles	46.9%	Incorrect position, direction, speed	Base Services	21.6%
		Incorrect position, direction, speed	Industrial Services	21.6%
		Incorrect position, direction, speed	Pier Services	21.6%
		Contact with/struck against	Pier Services	21.6%
Providing industrial systems/equipment	17.7%	System/equipment unavailable	Base Services	51.9%
		Strain	Base Services	10.8%
		Poor quality products, services, or operations	Base Services	10.3%
		Poor quality products, services, or operations	Industrial Services	6.2%
		Slip, trip, fall	Base Services	5.7%
Providing sewage services	10.1%	Inadequate/no sewage services	Base Services	98%
Providing/maintaining structures	8.6%	Excessive dynamic structural loading	Base Services	22.4%
		Excessive static structural loading	Pier Services	22.4%
		Structural degradation	Base Services	11.8%
		Excessive dynamic structural loading	Pier Services	11.8%
		Structural degradation	Pier Services	11.8%



†Risk Index Number

*"Other" contains lower risk locations. The following locations are included: firing range, armory, and Bldg. 2.

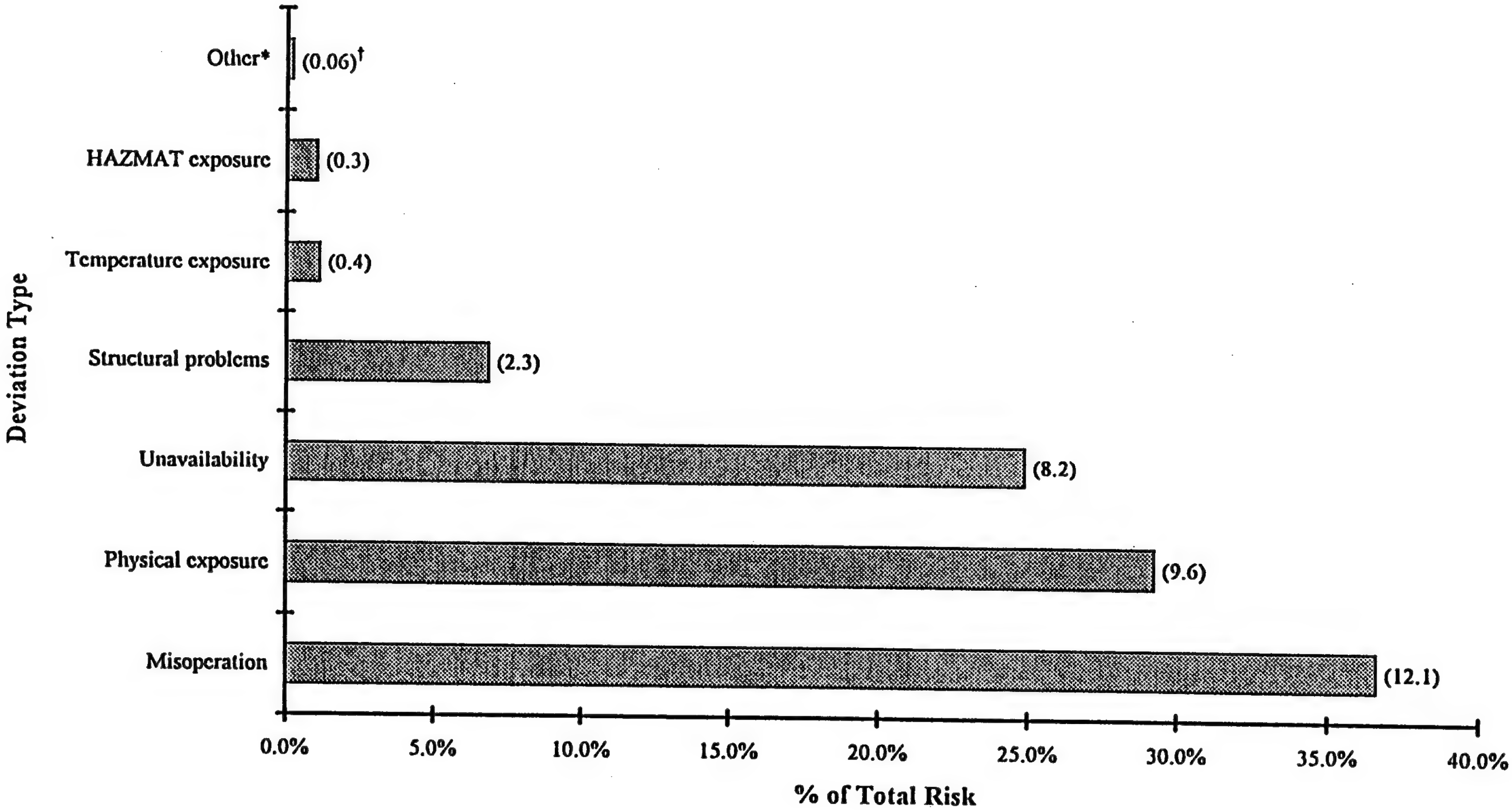
Figure 5 Risk Contribution of Locations — ISC Seattle

Table 10 High Risk Locations

Locations Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Location Risk			Deviation Risk Contribution to Location
		Deviation	Operation/ Evolution	Function	
Bldg. 3	33.7%	System/equipment unavailable	Base Services	Providing industrial systems/equipment	27.3%
		Incorrect position, direction, speed	Base Services	Operating powered vehicles	25.0%
		Strain	Base Services	Providing industrial systems/equipment	5.7%
		Poor quality products, services, or operations	Base Services	Providing industrial systems/equipment	5.4%
		Poor quality products, services, or operations	Industrial Services	Providing industrial systems/equipment	3.2%
		Slip, trip, fall	Base Services	Providing industrial systems/equipment	3.0%
		Slip, trip, fall	Base Services	Recreation services	3.0%
		Contact with/struck against	Base Services	Providing industrial systems/equipment	2.8%
		Hot/cold surfaces/materials exposure	Base Services	Providing industrial systems/equipment	2.7%
		Incorrect position, direction, speed	Industrial Services	Operating powered vehicles	2.7%
Pier 36	29.1%	Incorrect position, direction, speed	Pier Services	Operating powered vehicles	31.6%
		Contact with/struck against	Pier Services	Operating powered vehicles	31.6%
		Inadequate/no sewage services	Base Services	Providing sewage services	11.5%
		Excessive static structural loading	Pier Services	Operating/maintaining structures	6%

Table 10 High Risk Locations (cont'd)

Locations Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Location Risk			Deviation Risk Contribution to Location
		Deviation	Operation/ Evolution	Function	
Bldg. 7	10.8%	Incorrect position, direction, speed	Industrial Services	Operating powered vehicles	84.4%
Pier 37	7.8%	Inadequate/no sewage services	Base Services	Providing sewage services	42.8%
		Incorrect position, direction, speed	Pier Services	Operating powered vehicles	11.8%
		Contact with/struck against	Pier Services	Operating powered vehicles	11.8%
		Struck by/contact by	Pier Services	Operating powered vehicles	6.5%
		Vehicle unavailable	Pier Services	Operating powered vehicles	5.9%
		Strain	Pier Services	Operating hand-operated moving equipment	4.3%



†Risk Index Number
*"Other" contains lower risk deviation types. The following deviation types are included: radition exposure, noise/vibration exposure, weapons issues, and biological exposure.

Figure 6 Risk Contribution of Deviation Types — ISC Seattle

Table 11 High Risk Deviation Types

Deviation Types Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Deviation Type Risk			Deviation Risk Contribution to Deviation Type
		Deviation	Operation/ Evolution	Function	
Misoperation	36.6%	Incorrect position, direction, speed	Base Services	Operating powered vehicles	27.6%
		Incorrect position, direction, speed	Industrial Services	Operating powered vehicles	27.6%
		Incorrect position, direction, speed	Pier Services	Operating powered vehicles	27.6%
Physical exposure	29.3%	Contact with/struck against	Pier Services	Operating powered vehicles	34.6%
		Strain	Base Services	Providing industrial systems/equipment	6.5%
		Strain	Industrial Services	Operating lifting equipment	6.3%
		Strain	Base Services	Operating hand-operated moving equipment	3.7%
		Strain	Industrial Services	Operating hand-operated moving equipment	3.7%
		Slip, trip, fall	Base Services	Providing industrial systems/equipment	3.5%
		Struck by/contact by	Pier Services	Operating powered vehicles	3.5%
		Slip, trip, fall	Base Services	Providing recreation services	3.5%
		Slip, trip, fall	Base Services	Providing berthing services	3.4%
		Strain	Pier Services	Operating hand-operated moving equipment	3.4%
		Caught in, on, by, between	Industrial Services	Operating lifting equipment	3.4%

Table 11 High Risk Deviation Types (cont'd)

Deviation Types Contributing to ~80% of Facility Risk	Risk Contribution to Facility	Deviations Contributing to ~80% of Deviation Type Risk			Deviation Risk Contribution to Deviation Type
		Deviation	Operation/ Evolution	Function	
Physical exposure (cont'd)	29.3%	Strain	Industrial Services	Providing warehousing services	3.4%
		Contact with/struck against	Base Services	Providing industrial systems/equipment	3.2%
Unavailability	24.9%	Inadequate/no sewage services	Base Services	Providing sewage services	40.2%
		System/equipment unavailable	Base Services	Providing industrial systems/equipment	36.9%
		System/equipment unavailable	Base Services	Providing electrical power services	7.3%

Table 12 Risk Contribution of Locations by Function — ISC Seattle*

Location	Function Type											Total †
	Operating powered vehicles	Providing industrial systems/ equipment	Providing sewage services	Operating/ maintaining structures	Providing electrical power services	Operating lifting equipment	Providing berthing services	Providing warehousing services	Operating hand-operated moving equipment	Providing trash removal services	Providing recreation services	
Bldg. 3	10.6%	17.7%	—	2.0%	0.9%	0.3%	—	0.2%	0.4%	—	1.0%	33.1%
Pier 36	20.4%	—	3.4%	3.7%	0.3%	0.1%	—	—	0.3%	0.3%	—	28.5%
Bldg. 7	9.9%	—	—	0.1%	0.2%	—	—	—	0.5%	—	—	10.7%
Pier 37	3.0%	—	3.4%	0.3%	0.3%	0.1%	—	—	0.3%	0.4%	—	7.8%
Floating Dock	—	—	3.4%	0.5%	0.3%	0.1%	—	—	0.3%	0.3%	—	4.9%
Bldg. 1	—	—	—	1.8%	0.9%	—	—	—	—	—	—	2.7%
Vessel	—	—	—	—	—	2.6%	—	—	—	—	—	2.6%
HAZMAT	0.5%	—	—	—	—	—	—	0.9%	0.5%	—	—	1.9%
Mag.	1.2%	—	—	—	0.3%	—	—	—	0.4%	—	—	1.9%
Roads	1.2%	—	—	—	—	—	—	—	0.4%	—	—	1.6%
BEQ	—	—	—	—	0.3%	—	1.2%	—	—	—	—	1.5%
Bldg. 2	—	—	—	0.2%	0.2%	—	—	—	—	—	—	0.4%
Armory	—	—	—	—	0.3%	—	—	—	—	—	—	0.3%
Firing Range	—	—	—	—	—	—	—	—	—	—	—	0%

* Table values are percentages of overall facility risk (based on an ISC RIN of 32.9). Functions contributing less than 1% to overall facility risk are not listed. A dash means the function was not analyzed for the location. Zero percent means that the percentage was less than 0.1%.
† The totals will not sum to 100% since functions contributing less than 1% to overall facility risk are not listed in the table.

Table 13 Risk Contribution of Deviation Types by Function — ISC Seattle*

Deviation Type	Function Type											Total †
	Operating powered vehicles	Providing industrial systems/ equipment	Providing sewage services	Operating/ maintaining structures	Providing electrical power services	Operating lifting equipment	Providing berthing services	Providing warehousing services	Operating hand-operated moving equipment	Providing trash removal services	Providing recreation services	
Misoperation	31.6%	2.9%	0%	—	1.8%	0.2%	0%	0%	0%	0%	0%	36.5%
Physical Exposure	12.5%	4.5%	0.1%	1.3%	0%	3.0%	1.2%	1.1%	3.2%	0.9%	1.0%	28.8%
Unavailability	2.8%	9.2%	10.0%	—	1.8%	0%	0%	0%	0%	0.1%	0%	23.9%
Structural Problems	—	—	—	6.8%	—	—	—	—	—	—	—	6.8%
Temperature Exposure	—	0.9%	0%	0.1%	0%	0%	0%	0%	0%	0%	0%	1.0%
HAZMAT Exposure	0%	0.2%	0%	0.3%	0.1%	0%	0%	0%	0%	0%	0%	0.6%
Biological Exposure	0%	0%	0.1%	0%	0%	0%	0%	0%	0%	0%	0%	0.1%
Weapons Issues	—	—	—	—	—	—	—	—	—	—	—	0%
Noise/Vibration Exposure	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Radiation Exposure	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

* Table values are percentages of overall facility risk (based on an ISC RIN of 32.9). Functions contributing less than 1% to overall facility risk are not listed. A dash means the function was not analyzed for the location. Zero percent means that the percentage was less than 0.1%.

† The totals will not sum to 100% since functions contributing less than 1% to overall facility risk are not listed in the table.

7. OBSERVATIONS

This section presents observations on the coarse hazard analysis results.

7.1 ANALYSIS SCOPE OBSERVATIONS

- Because of time constraints, not all functions for each evaluated operation/evolution were addressed by the hazard analysis team. However, all ISC functions perceived as the most significant for the facility's risk were evaluated. This information should support meaningful risk management decisions.

7.2 FACILITY RISK OBSERVATIONS

- The risk matrix in Figure 2 shows a distribution of potential Class A/B, Class C, and Class D mishaps. The number of potential mishaps decrease on a straight line as mishap severity increases, with the majority of potential Class A/B mishaps being even lower than an imagined line would suggest (indicating an emphasis on reducing large consequence mishaps). This type of result is common for a facility that has been operated for a relatively long time and has focused on protecting against very significant or very frequent mishaps.

- The first four deviations shown in Table 5 (high risk deviations) are associated with operating powered vehicles. Powered vehicles have limited space for maneuvering, both on the piers and on the roads/parking lots. Combining this restriction with the amount of activity required to support vessels in-port, it is somewhat expected that a majority of the most significant deviations would involve operating powered vehicles. Although private and government vehicles ignoring ISC traffic laws contribute to the risk of these deviations, the higher risk contributors involve forklifts.

- The last two deviations in Table 5 (inadequate/no sewage service and system/equipment unavailable) deal with losses beyond those directly affecting safety (e.g., economic or mission impacts). Inadequate/no sewage represents mission and environmental impacts associated with degraded sewage services. System/equipment unavailable represents economic and mission impacts associated with equipment unavailability within Base Services. This deviation entails the costs of contracting off base for replacement services.

- The expected frequency of mishap events shown in Table 6 (overall evaluation results) appears to be reasonable for a facility providing industrial and personnel support. The Class D mishap

estimates appear high but more than likely reflect a higher occurrence of numerous, low cost Class D events (e.g., minor equipment damage from vehicle impacts).

- Comparing the team's estimated mishap frequencies with actual mishap frequencies derived from MISREP data (Table 7), the team's estimates are higher than those found in the MISREP database, particularly on Class D mishap estimates. A number of factors influence the discrepancy between analysis results and MISREP data:

  (1) Four of the six significant deviations listed in Table 5 are associated with physical impacts by powered equipment. The subject matter experts had seen the results of numerous vehicle and forklift incidents (which were reflected in their deviation risk responses). These events were probably low cost mishaps that went unreported. This is believed to be the dominant reason for the discrepancy between the analysis results and MISREP data for Class D (possibly Class C) mishaps.

  (2) Two of the six significant deviations in Table 5 are associated with equipment unavailability or loss of a service (the analysis searched for losses beyond health and safety losses). These deviations had economic, mission, or environmental impacts that would not be reported in the MISREP system (especially mission or environmental events)

  (3) The team may have been influenced by recent mishap events, causing them to overestimate mishap event frequencies and assign higher frequency scores.

7.3 OPERATION/EVOLUTION RISK OBSERVATIONS

Base Services and Pier Services are the higher risk operations/evolutions (see Figure 3). Table 8 shows that the risk of providing Base Services is affected the most by (1) operating powered vehicles and (2) operating industrial systems/equipment. Powered vehicle operations for Base Services include both base traffic and forklift traffic (both leading to physical contact mishaps). Table 8 shows that the risk of providing Pier Services (see Figure 3) is also affected the most by operating powered vehicles, which leads to equipment damage and loss and physical contact injuries.

7.4 FUNCTION RISK OBSERVATIONS

Operating powered vehicles is the dominate risk contributing function (see Figure 4). Table 9 shows that the main contributor to operating powered vehicles is from incorrect position, direction, speed and contact with/struck against, which leads to equipment damage and loss and physical contact injuries.

7.5 LOCATION RISK OBSERVATIONS

Building 3 and Pier 36 are the higher risk contributing locations (see Figure 5). Table 10 shows that the main contributor to Building 3 risk is unavailability of industrial systems/equipment (mainly facility engineering equipment), which results in economic losses (the ISC would contract out for replacement services) and mission losses. Pier 36 risk is driven by misoperation of powered vehicles and physical injury associated with powered vehicles. Vehicle maneuvering space is tight on the piers, and vehicles can enter the flow of traffic from several locations, increasing the risk of accidents.

7.6 DEVIATION TYPE RISK OBSERVATIONS

Misoperation, physical exposure, and unavailability are the higher risk deviation types (see Figure 6). Table 11 shows that powered vehicle deviations dominate misoperation and physical exposure risk and lead to equipment damage and physical exposure. Unavailability risk is driven by degraded sewage services (which result in environmental and mission losses) and the unavailability of facility engineering equipment (which results in economic and mission losses).

8. RECOMMENDATIONS

The following are the recommendations developed by the ISC Seattle coarse hazard analysis team to help reduce the risks of potential mishaps.

OPERATING VESSELS, VEHICLES, AIRCRAFT, OR EQUIPMENT

Recommendation 1 [Δ*RIN* (14.76, *Revised RIN*)]*†

Consider dedicating full-time personnel to forklift operations. This action is designed to lower the frequency of potential forklift mishaps by ensuring that only experienced personnel operate the equipment.

Recommendation 2 [Δ*RIN* (0.9, *Revised RIN*)]

Consider creating a centralized office for administering powered equipment. Currently, the equipment is issued at three locations on base: Facility Engineering, NESU, and Comptroller. A centralized office could keep track of all the equipment, coordinate equipment scheduling, and maintain equipment preventive maintenance records.

Recommendation 3 [Δ*RIN* (7.23, *Revised RIN*)]

Consider providing additional lighting in Building 7 and Building 3 to increase visibility. This will help reduce the likelihood of misjudgments by forklift and equipment operators.

Recommendation 4 [Δ*RIN* (0.04, *Revised RIN*)]

Consider implementing a USCG policy on periodic rests for crane operators (e.g., 15 minutes every 2 hours). This will minimize the potential for fatigue-related errors by the operator.

Recommendation 5 [Δ*RIN* (1.11, *Revised RIN*)]

Consider modifying safety standards to allow the purchase of steel-toed shoes that have soft, nonslip soles. This will address the need for protection against both falling objects and slipping hazards. Current steel-toed shoes have hard soles that slip easily on floor and step surfaces.

*This analysis did not include determining the risk reduction of recommendations; however, a standard analysis would be expected to include this information.

†[Change in RIN if the recommendation is implemented (Initial RIN, Revised RIN)]

Recommendation 6 [Δ*RIN* (6.78, *Revised RIN*)]

Consider providing warning lights at building exits and at pier entrances/exits to slow down powered equipment as it transits into/out of buildings/piers. This will minimize the likelihood of powered equipment being struck by a vehicle that has failed to yield the right-of-way.

Recommendation 7 [Δ*RIN* (6.78, *Revised RIN*)]

Consider installing four-way stop signs, which will require powered equipment to stop when exiting buildings. This will minimize the likelihood of powered equipment being struck by a vehicle that has failed to yield the right-of-way.

Recommendation 8 [Δ*RIN* (7.11, *Revised RIN*)]

Consider implementing a policy requiring vehicles to give right-of-way to forklifts and powered equipment. This will help prevent incidents where a forklift must try to stop abruptly to avoid an oncoming vehicle.

Recommendation 9 [Δ*RIN* (0.07, *Revised RIN*)]

Consider providing spill kits on the forklifts to enable immediate response to liquid spills near storm water drains. Forklifts often transport hazardous materials. A forklift driver may need to react immediately to a material spill to prevent materials from entering the storm water system.

Recommendation 10 [Δ*RIN* (0.9, *Revised RIN*)]

Consider streamlining the chain of command for processing requisitions for powered equipment spare parts to allow rapid replacement of spare parts. This would increase powered equipment availability for ISC users and tenant commands.

Recommendation 11 [Δ*RIN* (13.47, *Revised RIN*)]

Consider requiring periodic requalification training for forklift operators based on (1) the length of time since previous training and (2) operating time. This will help ensure that anyone operating powered equipment is adequately trained.

Recommendation 12 [Δ*RIN* (10.05, *Revised RIN*)]

Consider requiring chains for operating powered equipment in icy weather. This will reduce the likelihood of loss of control of the equipment. Equipment with chains could be staged in outside areas for use on icy surfaces, thereby avoiding use of the equipment indoors (which could tear up floor surfaces).

Recommendation 13 [Δ*RIN* (13.47, *Revised RIN*)]

Both the ISC and tenant command (including vessels) should consider requiring unit all-hands training on forklift operations. The training should be designed to increase overall awareness of forklift issues such as scheduling, safety, and traffic patterns.

Recommendation 14 [Δ*RIN* (0.39, *Revised RIN*)]

Consider posting speed limit signs at additional locations on the piers. Vehicle and equipment operators are frequently exceeding speed limits on the piers.

Recommendation 15 [Δ*RIN* (0.04, *Revised RIN*)]

Consider implementing a USCG policy on training riggers on load-lifting operations. This will avoid relying solely on on-the-job training and local policies for safe load-lifting practices and will also help ensure that these practices are consistently implemented by all shore-based riggers.

Recommendation 16 [Δ*RIN* (3.33, *Revised RIN*)]

Consider point-system penalties for motor vehicle violations, which would be applied to base-driving privileges. This will help minimize repeated violations.

Recommendation 17 [Δ*RIN* (3.33, *Revised RIN*)]

Consider adding seat belt violations to the point system for limiting base-driving privileges. This will help minimize repeated violations.

Recommendation 18 [Δ*RIN* (3.33, *Revised RIN*)]

Consider increasing the frequency of all-hands training on motor vehicle safety (ISC and tenant commands). This will help ensure that all personnel are attentive to motor vehicle safety issues.

Recommendation 19 [Δ*RIN* (3.33, *Revised RIN*)]

Consider more strictly enforcing motor vehicle moving violations per the ISC Standard Operating Procedure. This will help minimize motor vehicle violations.

Recommendation 20 [Δ*RIN* (3.33, *Revised RIN*)]

Consider more strictly enforcing the requirement that ISC tenant commands follow the ISC Standard Operating Procedure and COMDINST when operating motor vehicles. This will help minimize motor vehicle violations.

OPERATING/MAINTAINING STRUCTURES

Recommendation 21 [Δ*RIN* (0.66, *Revised RIN*)]

Consider defining a program of (1) regular visual inspections of piles supporting Pier 37, Pier 36, Building 3, and the apron for Piers 36/37 and (2) selective nondestructive examinations (e.g., ultrasonic tests) of wooden piles supporting Pier 36, Building 3, and the apron for Piers 36/37. Regular inspections and examinations can identify maintenance issues and reduce the risk associated with structural failures.

Recommendation 22 [Δ*RIN* (0.39, *Revised RIN*)]

Consider modifying the guides that keep the floating dock in place to (1) help prevent damage to the piles and (2) reduce the potential for personnel injury during maintenance (being caught between the guide and piles). The guides were designed for a cylindrical wood pile. The current piles are octagonal (or some other multisided geometric shape) and are made of concrete. The shape and design of the guides damage the piles and require frequent maintenance. A new guide design suited for the piles design should be chosen.

Recommendation 23 [Δ*RIN* (0.66, *Revised RIN*)]

Consider developing and implementing a method to regularly check structures for gross movement/deflection using simple visual observations. A marking method across structural joints can indicate structural problems before a serious loss occurs.

Recommendation 24 [Δ*RIN* (0.63, *Revised RIN*)]

Consider implementing a formal system for keeping personnel (especially new personnel) who are responsible for movement/placement of heavy loads aware of (1) current load limits on the piers and in

Building 3 and (2) the types of loads that may exceed those limits. This system should address the roles of base personnel, vessel personnel, and security guards in making sure that load limits are not exceeded.

Recommendation 25 [Δ*RIN* (0.09, *Revised RIN*)]

Consider ensuring that existing secondary emergency exits for Building 1 are (1) readily identifiable from within the building and (2) provide unobstructed egress from the building 24 hours a day. Some emergency exit signs were missing in Building 1, and some of the emergency exits located within a room were inaccessible after hours because the room was locked.

Recommendation 26 [Δ*RIN* (0.003, *Revised RIN*)]

Consider including in routine safety meetings information about site asbestos and lead exposure risks (and associated protection precautions). Due to the age of the buildings and the frequency of maintenance, routinely reminding employees of the asbestos and lead hazards can help reduce unnecessary exposure.

Recommendation 27 [Δ*RIN* (0.63, *Revised RIN*)]

Consider taking additional steps to protect the side of Building 1 from vehicles that may lose control on the road outside of the site. Building 1 is within a couple of feet of a major thoroughfare and is unprotected from a vehicle collision.

Recommendation 28 [Δ*RIN* (0.3, *Revised RIN*)]

Consider providing a nonskid surface along the emergency escape path on the roof of Building 1. The escape path on the roof is very slick and may present a significant slipping hazard during a hasty evacuation of Building 1.

Recommendation 29 [Δ*RIN* (0.09, *Revised RIN*)]

Consider providing fire protection insulation for the exposed structural steel members in Building 3. Insulation would help prevent the paint on the structural members from burning. Burning paint may weaken the structural members and cause them to collapse.

Recommendation 30 [Δ*RIN* (0.3, *Revised RIN*)]

Consider repairing the uneven walkway outside of Building 1. The walkway is a tripping hazard.

Recommendation 31 [Δ*RIN* (0.09, *Revised RIN*)]

Consider upgrading Building 1 to make emergency exit paths in all areas of the building consistent with current code requirements. Emergency exits consistent with codes will help to ensure efficient and effective evacuation of the building during a fire.

Recommendation 32 [Δ*RIN* (0.3, *Revised RIN*)]

Consider raising the railing in the fifth floor stairwell of Building 1. The fifth floor stairwell railing is too low for current codes. There is a risk of someone slipping or losing their balance and falling over the railing.

Recommendation 33 [Δ*RIN* (0.03, *Revised RIN*)]

Consider fastening the shelves on the steel frames of storage bins in Building 3 (and other areas as applicable) to reduce the likelihood of equipment falling from the shelves. The shelving in some areas is not fastened to the steel frames. As materials are placed on or removed from the shelves, the shelves may slide, causing the shelving and materials to fall.

Recommendation 34 [Δ*RIN* (0.96, *Revised RIN*)]

Consider implementing a system to ensure that structures are appropriately inspected after an earthquake in the Seattle area. An appropriate method for assessing damage from an earthquake will help ensure that potential structural issues are discovered and addressed.

Recommendation 35 [Δ*RIN* (0.33, *Revised RIN*)]

Consider defining an appropriate inspection/monitoring program for the piles supporting the foundations of Building 1, Building 2, and Building 7. These buildings were built on fill land next to the sound and are more than 70 years old. Inspection and monitoring of the piles will identify potential structural issues.

Recommendation 36 [Δ*RIN* (0.09, *Revised RIN*)]

Consider upgrading the fire alarm system in Building 1. The current fire alarm system does not meet code and may not sufficiently warn the occupants of a fire.

Recommendation 37 [Δ*RIN* (0.09, *Revised RIN*)]

Consider installing a sprinkler system in Building 1. A sprinkler system would give the occupants of Building 1 additional time to evacuate the building and would help mitigate fire damage.

Recommendation 38 [Δ*RIN* (Screened, *Revised RIN*)]

Consider implementing routine tests to ensure the dependability of safety switches on motor-driven doors. Periodically testing the switches will help ensure that the safety mechanism prevents the door from causing serious damage to personnel or equipment.

Recommendation 39 [Δ*RIN* (0.09, *Revised RIN*)]

Consider implementing a formal test program for the fire protection system installed under Pier 36, Building 3, and the apron for Piers 36/37. The reliability of the fire protection system is questionable. A test program would help ensure more reliable operation.

Recommendation 40 [Δ*RIN* (0.63, *Revised RIN*)]

Consider installing shear walls in Building 1 and Building 7 to help minimize the vulnerability of those buildings to structural damage in the event of a significant earthquake. The shear walls will correct some of the seismic design weaknesses in these buildings and improve the buildings' resilience to earthquakes.

Recommendation 41 [Δ*RIN* (0.06, *Revised RIN*)]

Consider replacing the transition piece between the boathouse and the floating dock with a curved plate (instead of the current flat plate). As the floating dock and boathouse move independently, the transition piece becomes a tripping hazard as it is currently designed.

PROVIDING SERVICES/UTILITIES

Recommendation 42 [Δ*RIN* (0.006, *Revised RIN*)]

Consider providing a filtration system for the drinking water piping in Building 1. The water in Building 1 contains a reportable quantity of lead, and a filtration system may correct the problem.

Recommendation 43 [Δ*RIN* (0.3, *Revised RIN*)]

Consider modifying the compressed air system, air supply lines, or the firewater sprinkler system in Building 3 to reduce the number of times that water must be removed from the sprinkler piping as a result of leaks in the air supply lines. The air supply lines leak. If the compressed air system fails, the air supply lines eventually lose enough pressure to actuate the firewater sprinkler system control valves and flood the normally dry portion of the sprinkler system (sprinkler water is not discharged into the building because the sprinkler heads remain closed). Failure of one or more sprinkler heads under these conditions may cause economic damage. Also, the firewater sprinkler system must be dried out each time this occurs.

Recommendation 44 [Δ*RIN* (0.006, *Revised RIN*)]

Consider replacing the piping and fixtures in the water supply lines for Building 1 to eliminate lead exposure risks in the building's potable water supply. The water in Building 1 contains a reportable quantity of lead, and replacing the piping and fixtures in the water supply line may correct the problem.

Recommendation 45 [Δ*RIN* (0.006, *Revised RIN*)]

Consider providing a backflow preventer to keep particulates in the firewater system from entering the potable water system in the event of a loss of potable water supply pressure. The firewater system may contain foreign matter unsuitable for potable water use, and loss of water supply pressure may allow water in the firewater system to contaminate the potable water system.

Recommendation 46 [Δ*RIN* (Screened, *Revised RIN*)]

Consider providing sound barriers around air compressors to eliminate the need for hearing protection in areas where compressors are operating. It is difficult to require (and enforce) hearing protection around some compressors due to their location. Placing sound barriers around these compressors may eliminate the need for hearing protection.

Recommendation 47 [Δ*RIN* (Screened, *Revised RIN*)]

Consider whether hearing protection should be worn at all times in areas where loud, periodically operating equipment (e.g., generators, compressors) could start at any time. Some locations contain equipment (e.g., generators) that only operates periodically. Sound surveys should be considered to determine whether hearing protection is warranted in these areas.

Recommendation 48 [Δ*RIN* (0.03, *Revised RIN*)]

Consider immunizing all maintenance personnel against hepatitis due to possible contact with the sewage system. This will help provide workers the assurance that they are protected and will avoid the need for extensive testing of workers for hepatitis.

Recommendation 49 [Δ*RIN* (0.96, *Revised RIN*)]

Consider improving craft training in specific technologies (especially new technologies such as PC controllers). Methods considered inefficient by today's technological standards are often used due to the lack of craft skills. New and improved skills can increase productivity and reduce cost.

Recommendation 50 [Δ*RIN* (1.2, *Revised RIN*)]

Consider defining an appropriate preventive maintenance program for the high voltage transformers/switchgear at the site. Currently, there is no formal preventive maintenance program for this equipment.

Recommendation 51 [Δ*RIN* (1.2, *Revised RIN*)]

Consider transferring operation of high voltage transformers/switchgear at the site to the local utility. The local utility is more qualified to maintain the transformers and switchgear, and transferring this operation will reduce the Coast Guard's risk associated with high voltage operations.

Recommendation 52 [Δ*RIN* (0.6, *Revised RIN*)]

Consider implementing a formal system defining how base personnel will monitor contractor work and equipment/materials provided by contractors to identify/correct potential quality problems. A formal system will help the Coast Guard ensure that contractors are providing quality services and materials.

Recommendation 53 [Δ*RIN* (0.06, *Revised RIN*)]

Consider periodically inspecting or replacing the hose used to refuel vessels at the floating dock. There is currently no inspection or replacement requirement for the refueling hose. A hose failure could result in a fire or environmental impact.

Recommendation 54 [Δ*RIN* (0.06, *Revised RIN*)]

Consider providing secondary containment (e.g., a curbed area) for the fuel unloading area near the underground fuel storage tank to help prevent fuel spills from entering Puget Sound. A spill during fuel unloading would enter the storm water system. Secondary containment would give the Coast Guard time to remove the spill before it enters Puget Sound, causing environmental impact.

Recommendation 55 [Δ*RIN* (0.03, *Revised RIN*)]

Consider implementing an ISC instruction requiring vessel Commanding Officers to be aware of and implement safeguards needed when handling/transferring ammunition on/off vessels. Acceptable ammunition safeguards have not been consistently implemented by vessels moored at the ISC.

Recommendation 56 [Δ*RIN* (0.06, *Revised RIN*)]

Consider replacing the current fueling system for the floating dock with a system positioned on the apron for Piers 36/37 and a boom that extends to the fueling positions. The hose for the fueling system is attached (below the water line) to multiple floating structures that can move independently of one another. The system is basically unprotected from severe weather/waves and vessels and could be ruptured, resulting in environmental impact. The apron would provide a stable, more protected location for the system.

Recommendation 57 [Δ*RIN* (0.09, *Revised RIN*)]

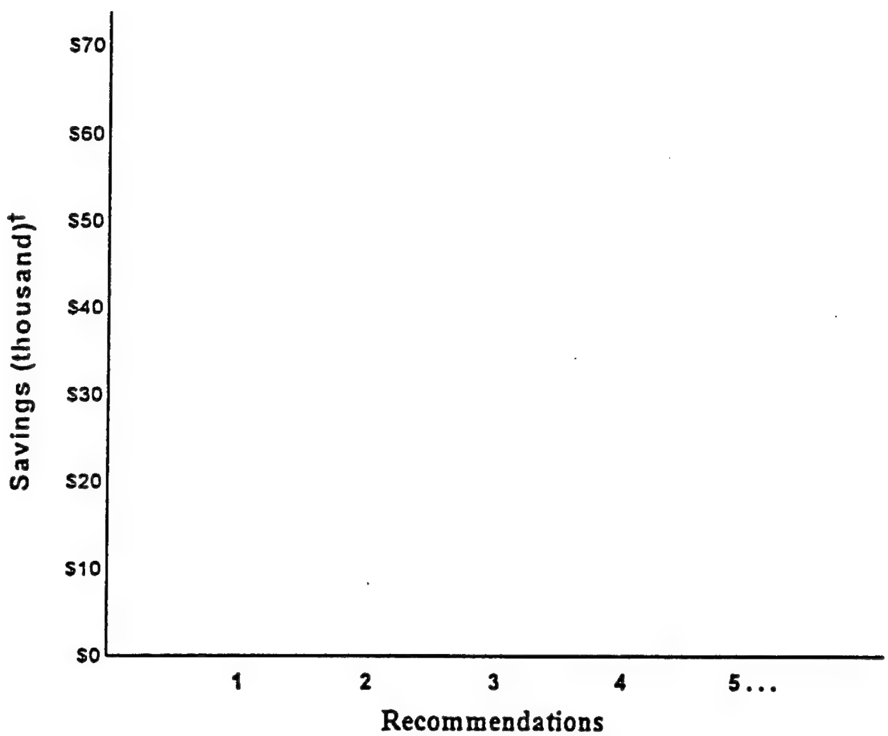
Consider training on the physical hazards associated with lifting/transferring small arms ammunition. This will help minimize the occurrence of strain-type injuries.

Recommendation 58 [Δ*RIN* (0.03, *Revised RIN*)]

Consider providing contracted security personnel (armed) for roving security watchstanding functions. This will help ensure adequate security enforcement under a single command.

9. BENEFIT OF IMPLEMENTING RECOMMENDATIONS

Attachment B provides a means for quantitatively assessing the benefit of implementing the recommendations discussed in Section 8. The benefit of implementing a recommendation is assessed by establishing the reduction in risk that is expected if the recommendation is implemented. Refer to Reference 1 for guidance on evaluating the recommendations. Figure 7 shows the estimated risk reduction ($/year) associated with each recommendation. (Determining the risk reduction of recommendations is out of the scope of this analysis; however, Figure 7 and Table B.1 have been included for demonstration purposes. This exercise would normally be performed for a standard analysis.)



† Savings estimate assumes Class A/B mishaps cost $300,000 and Class C/D mishaps cost $30,000.

Note: Savings shown account for 50-year life of a vessel.

Figure 7 Estimated Range of Dollar Savings from Implementing Recommendations

10. CONCLUDING REMARKS

This section is for discussing conclusions that can be made from the analysis. Because this analysis did not include evaluating the recommendations, this section cannot be completed. In a standard report, this section should answer the following questions:

- *What are observations about the potential risk reduction for the facility if all of the recommendations are implemented?*
- *Were recommendations generated for the high risk deviations?*
- *What functions or deviations should be considered for additional risk reduction recommendations?*
- *Which recommendations appear to be the most effective in reducing risk?*
- *Which recommendations appear to be of marginal benefit?*
- *Should the coarse hazard analysis be extended or broadened to cover other areas?*
- *Would a detailed analysis be beneficial and, if so, what subject should be analyzed?*

11. REFERENCES

1. Integrated Safety Assessment (ISA) User's Manual (available from the RDC).

2. COMDINST M5100.47, USCG Safety and Environmental Health Manual.

ATTACHMENT A

COARSE HAZARD ANALYSIS TABLE FOR ISC SEATTLE

Table A.1 Course Hazard Analysis for ISC Seattle

Structures (Buildings, Piers, Vessels, Craft) - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.1	Excessive static structural loading	Exceeding load limits in Bldg. 3 due to storing materials or operating fork truck	Equipment damage/loss - local failure of floor in Bldg. 3; damage to equipment from floor failure	2	2	1	.003303		Load limit plan for Bldg. 3	24
		Exceeding load limits in Bldg. 1 due to the file cabinets	Hazardous exposure: contact injury							
Comments: Bldg. 3 - High risk Bldg. 1 - Medium risk Bldgs. 2, 7 - Low risk										
1.2	Excessive dynamic structural loading	Seismic event	Equipment damage/loss	4	5	5	.63			27
		High winds								34
		Vehicles striking building								40
Comments: Bldgs. 1, 3 - High risk Bldg. 2 - Medium risk Bldg. 7 - Low risk										
1.3	Structural degradation	Floor creep from age, buckling of floor, Bldg. 1	Equipment damage/loss	4	4	4	.333		Inspection of pilings	21
		Degradation of the wood piling, Bldg. 3							Periodic inspection of the seawall	23
		Soiled erosion behind sea wall, Bldg. 3								35
Comments: Bldg. 3 - High risk Bldg. 1 - Medium risk Bldgs. 2, 7 - Low risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Structures (Buildings, Piers, Vessels, Craft) - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.4	Caught in/ on/by/between		Screened							
Comments:										
1.5	Struck by/contact by	Doors, windows Roll up doors in Bldg. 3 and Bldg. 7	Screened	1	3	4	.0063		Interlock on the bottom of the rollup door to stop it if it hits something (safety switches are not tested)	38
Comments: Bldgs. 3, 7 - High risk										
1.6	Slip/trip/fall	Railing too short in Bldg. 1 stairwell Uneven pavement	Hazardous exposure: contact injury	1	2	6	.3006			28 30 32
Comments: Bldg. 1 - High risk Bldgs. 2, 3, 7 - Medium risk										
1.7	Strain		Screened							
Comments:										
1.8	Toxic/corrosive/ reactive materials exposure	Lead paint, Bldg. 3 Asbestos - tiles, doors, insulation	Hazardous exposure: Toxic/corrosive materials	2			.0030033		Asbestos control program	26
Comments: Bldgs. 1, 2, 3, 7 - Medium risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Structures (Buildings, Piers, Vessels, Craft) - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.9	Fire/explosion	Kitchen fire, Bldgs. 1, 2, 3, 7	Equipment damage/loss	3	4	5	.09		Heat-activated sprinkler, Bldgs. 3, 7	25
		Welding, Bldg. 3	Fire/explosion						Fire extinguishers	29
		Propane leak or rupture, Bldgs. 1, 3, 7							Halon for Vessel Traffic System, Bldg. 1	31
		Natural gas leak or rupture, Bldgs. 3, 7							Pull stations, Bldg. 1	36
		Vehicle fire or fire caused by vehicles, Bldgs. 3, 7							Fire hydrants, Bldgs. 1, 2	37
									Seattle fire department is located near the base	39
									Fire department periodically performs courtesy inspections	
									Smoke alarms	
Comments: Bldgs. 1, 3 - High risk; Bldgs. 2, 7 - Medium risk										
1.10	Asphyxiant environment exposure		Screened							
Comments:										
1.11	Electrical hazards exposure	Portable heaters	Screened							
Comments:										
1.12	High pressure materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Structures (Buildings, Piers, Vessels, Craft) - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
1.13	High noise exposure		Screened							
Comments:										
1.14	Excessive vibration exposure		Screened							
Comments:										
1.15	Radiation exposure		Screened							
Comments:										
1.16	Biological hazards exposure		Screened							
Comments:										
1.17	Hot/cold environments exposure		Screened							
Comments:										
1.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										
1.19	Contact with/struck against		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Electrical Power - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
2.1	Inadequate/no electrical power service	Utility service problem Weather	Mission impact Bldg. 1: Loss of power to VTS Mission impact Bldg. 3: Delayed vessel mission (long-term outage results in mission impact)	4	5		.6000003		Uninterruptible (UPS) for Bldg. 1 Backup generator for Bldg. 1	50 51
Comments: Bldgs. 1, 3 - High risk Piers 36, 37; Floating Dock; Armory; Magazine; BEQ - Medium risk Bldgs. 2, 7 - Low risk										
2.2	Incorrect electrical power frequency, voltage, phase	Human error Seismic event Failure from offsite supply Failure from onsite equipment (e.g., transformer, switch gear) Lightning	Hazardous exposure: electrical shock Equipment damage/loss	1	5	6	.6003		Fuses Breakers	50 51
Comments: Piers 36, 37; Floating Dock; Bldgs. 1, 2, 3, 7; BEQ; Magazine; Armory - Medium risk										
2.3	Caught in/ on/by/between	Generators	Screened							
Comments:										
2.4	Struck by/contact by		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Electrical Power - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
2.5	Contact with/struck against		Screened							
Comments:										
2.6	Slip/trip/fall		Screened							
Comments:										
2.7	Strain	Pulling wire	Screened							
Comments:										
2.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
2.9	Fire/explosion	Human error (transformer explosion incident) Seismic event Overloaded circuits (Bldg. 1)	Screened							
Comments:										
2.10	Asphyxiant environment exposure	Generator in basement - stack only goes to second floor	Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
2.11	Electrical hazards exposure	Human error - Not following safe work practices No second-person check of electrician during electrical operations/maintenance	Hazardous exposure: electrical shock	1	3	5	.0333			
Comments: Piers 36, 37; Floating Dock; Bldgs. 1, 2, 3, 7; BEQ; Magazine; Armory - Medium risk										
2.12	High pressure materials exposure		Screened							
Comments:										
2.13	High noise exposure	Generators in Bldg. 1	Screened							47
Comments:										
2.14	Excessive vibration exposure		Screened							
Comments:										
2.15	Radiation exposure		Screened							
Comments:										
2.16	Biological hazards exposure		Screened							
Comments:										
2.17	Hot/cold environments exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Electrical Power - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
2.18	Hot/cold surfaces/materials exposure		Screened							

Comments:

Table A.1 Course Hazard Analysis for ISC Seattle

Potable Water Services - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
3.1	Inadequate/no potable water	Seismic event Utility supply lost	Screened			4	.003033			
Comments: Pier 37, Bldg. 1 - High risk Pier 36; Bldgs. 2, 3, 7 - Medium risk										
3.2	Potable water quality problem	Mineral deposits in water Rust in pipes Lead in pipes Brass fittings (piers) Turbidity Backflow of fire water system Cryptosporidian	Hazardous exposure: biological materials Hazardous exposure: Toxic/corrosive materials	2	3	3	.0063		Backflow preventors (main systems) Signs to run water for short period of time before drinking (1) Backflow preventor checks	42 44 45
Comments: Pier 37, Bldg. 1 - High risk Pier 36; Bldgs. 2, 3, 7 - Medium risk										
3.3	Caught in/ on/by/between		Screened							
Comments:										
3.4	Struck by/contact by		Screened							
Comments:										
3.5	Contact with/struck against		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
3.6	Slip/trip/fall		Screened							
Comments:										
3.7	Strain		Screened							
Comments:										
3.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
3.9	Fire/explosion		Screened							
Comments:										
3.10	Asphyxiant environment exposure		Screened							
Comments:										
3.11	Electrical hazards exposure		Screened							
Comments:										
3.12	High pressure materials exposure		Screened							
Comments:										
3.13	High noise exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Potable Water Services - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
3.14	Excessive vibration exposure		Screened							
Comments:										
3.15	Radiation exposure		Screened							
Comments:										
3.16	Biological hazards exposure		Screened							
Comments:										
3.17	Hot/cold environments exposure		Screened							
Comments:										
3.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.1	Inadequate/no berthing services		Screened							
Comments:										
4.2	Berthing quality problem		Screened							
Comments:										
4.3	Caught in/ on/by/between		Screened							
Comments:										
4.4	Struck by/contact by		Screened							
Comments:										
4.5	Contact with/struck against		Screened							
Comments:										
4.6	Slip/trip/fall	Water on floor in bathroom (shower curtain not big enough)	Hazardous exposure: contact injury	1	5	5	.3303			
Comments: BEQ - High risk										
4.7	Strain	Incorrect lift	Hazardous exposure: contact injury		4	5	.06003		Workplace safety training	
Comments: BEQ - High risk										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.8	Toxic/corrosive/ reactive materials exposure	Spill of cleaning chemicals Exposure to cleaning chemicals	Screened	1	3	4	.0063			
Comments:										
4.9	Fire/explosion	Space heaters Cigarette smoking in building	Screened						Fire alarm No-smoking policy Emergency lighting Fire extinguishers	
Comments:										
4.10	Asphyxiant environment exposure		Screened							
Comments:										
4.11	Electrical hazards exposure		Screened							
Comments:										
4.12	High pressure materials exposure		Screened							
Comments:										
4.13	High noise exposure		Screened							
Comments:										
4.14	Excessive vibration exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
4.15	Radiation exposure		Screened							
Comments:										
4.16	Biological hazards exposure		Screened							
Comments:										
4.17	Hot/cold environments exposure		Screened							
Comments:										
4.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.1	System/equipment unavailable	Materials out of stock, inadequate tools/equipment, or overloaded with large number of requests and cannot respond to issue	Economic impact	0	4	7	3.03003		Contractors Suppliers in Seattle area Industrial shops in Seattle area	
Comments: Bldg. 3 (Facility Engineering) - High risk										
5.2	Poor quality products, services, or operations	Poor quality contractor work Poor quality materials Final decision for tool procurement is made by non-technical personnel	Replacement/rework cost Mission impacts	2	5	6	.603		Contractor quality control program Final work inspection Trade training Prescreening and probationary period for new hires	49 52
Comments: Bldg. 3 (Facility Engineering) - High risk										
5.3	Caught in/ on/by/between	Human error Misoperation of equipment	Hazardous exposure: contact injury	2	3	5	.036		Machine guards PPE - safety glasses Shop training on good work practices	
Comments: Bldg. 3 (Facility Engineering) - High risk										
5.4	Struck by/contact by	Materials flying off machines	Hazardous exposure: contact injury	2	3	5	.036		PPE - safety glasses Shop training on good work practices	
Comments: Bldg. 3 (Facility Engineering) - High risk										

Table A.1 Course Hazard Analysis for ISC Scattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.5	Contact with/struck against	Sharp objects in shop area	Hazardous exposure: contact injury	2	3	6	.306		Machine guards Shop training on good work practices	
Comments: Bldg. 3 (Facility Engineering) - High risk										
5.6	Slip/trip/fall	Nails on the floor in carpentry shop Equipment/materials on the floor Human error on ladders	Hazardous exposure: contact injury	2	5	5	.333		Housekeeping policies	5
Comments: Bldg. 3 (Facility Engineering) - High risk										
5.7	Strain	Incorrect lift	Hazardous exposure: contact injury	3	5	6	.63		Training on lifting techniques	
Comments: Bldg. 3 (Facility Engineering) - High risk										
5.8	Toxic/corrosive/ reactive materials exposure	Misuse of acid Inhalation of machining/carpentry dust Welding fumes	Hazardous exposure: Toxic/corrosive materials	2	3	5	.036		PPE used during operations - rubber gloves, face shields, respirators Safety training program	
Comments: Bldg. 3 (Facility Engineering) - High risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Industrial Systems/Equipment - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.9	Fire/explosion	Incorrect use of welding gas Ignition of combustible materials in shops (e.g., rag bins, machine oil, boxes)	Fire/explosion	2	4	4	.036		Safety training Fire extinguisher Sprinkler system	
Comments: Bldg. 3 (Facility Engineering) - High risk										
5.10	Asphyxiant environment exposure		Screened							
Comments:										
5.11	Electrical hazards exposure		Screened						PMS of electrical equipment Personnel awareness	
Comments:										
5.12	High pressure materials exposure		Screened							
Comments:										
5.13	High noise exposure		Screened						Hearing conservation program PPE - hearing protection	
Comments:										
5.14	Excessive vibration exposure		Screened							
Comments:										
5.15	Radiation exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
5.16	Biological hazards exposure		Screened							
Comments:										
5.17	Hot/cold environments exposure		Screened							
Comments:										
5.18	Hot/cold surfaces/materials exposure	Hot welding materials Hot materials from grinding Hot materials from machining or cutting	Hazardous exposure: hot environment/surface/materials	1	1	6	.30033		PPE used during operations - gloves	
Comments: Bldg. 3 (Facility Engineering) - High risk										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
6.1	Inadequate/no compressed air	Mechanical failure of air pipes in sprinkler system	Economic impact: Dry sections of sprinkler system are flooded and must be drained	0	0	6	.300033 .0000333			43
Comments: Bldg. 3, Pier 36 - High risk										
6.2	Compressed air quality problem		Screened							
Comments:										
6.3	Caught in/ on/by/between		Screened						Machine guards	
Comments:										
6.4	Struck by/contact by	Break in hose	Screened							
Comments:										
6.5	Contact with/struck against		Screened							
Comments:										
6.6	Slip/trip/fall		Screened							
Comments:										
6.7	Strain		Screened							
Comments:										
6.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
6.9	Fire/explosion		Screened							
Comments:										
6.10	Asphyxiant environment exposure		Screened							
Comments:										
6.11	Electrical hazards exposure		Screened							
Comments:										
6.12	High pressure materials exposure		Screened							
Comments:										
6.13	High noise exposure	Working around compressors without hearing protection	Screened							46 47
Comments:										
6.14	Excessive vibration exposure		Screened							
Comments:										
6.15	Radiation exposure		Screened							
Comments:										
6.16	Biological hazards exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
6.17	Hot/cold environments exposure		Screened							
Comments:										
6.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
7.1	Inadequate/no compressed gases		Screened							
Comments:										
7.2	Compressed gas quality problem		Screened							
Comments:										
7.3	Caught in/ on/by/between		Screened							
Comments:										
7.4	Struck by/contact by		Screened							
Comments:										
7.5	Contact with/struck against		Screened							
Comments:										
7.6	Slip/trip/fall		Screened							
Comments:										
7.7	Strain	Incorrect lift of cylinders	Hazardous exposure: contact injury	0	0	5	.030033		Workplace safety training	
Comments: Bldg. 3 - High risk										
7.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
7.9	Fire/explosion		Screened							
Comments:										
7.10	Asphyxiant environment exposure		Screened							
Comments:										
7.11	Electrical hazards exposure		Screened							
Comments:										
7.12	High pressure materials exposure		Screened							
Comments:										
7.13	High noise exposure		Screened							
Comments:										
7.14	Excessive vibration exposure		Screened							
Comments:										
7.15	Radiation exposure		Screened							
Comments:										
7.16	Biological hazards exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
7.17	Hot/cold environments exposure		Screened							
Comments:										
7.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
8.1	Inadequate/no fueling services	Loss of electric power Failure of pumps Clogged lines	Screened						Other sources of fuel exist (truck in barrels of fuel to fill day tanks, vessels can go elsewhere)	
Comments:										
8.2	Fuel quality problem		Screened						Oil quality is checked as it is received Leak detection system on tank	
Comments:										
8.3	Caught in/ on/by/between		Screened							
Comments:										
8.4	Struck by/contact by		Screened							
Comments:										
8.5	Contact with/struck against		Screened							
Comments:										
8.6	Slip/trip/fall		Screened							
Comments:										
8.7	Strain		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
8.8	Toxic/corrosive/ reactive materials exposure	Severe waves (pulling hose connection loose on floating dock)	Hazardous exposure: Toxic/corrosive materials - environmental impact	2	4	5	.063		Shutoff valve for Floating Dock fuel line (can be closed during spill)	53
		Spill/leak during refueling of underground storage tank (UST) (No spill containment in UST refueling area) (e.g., truck tank leak, tank hose leak/rupture, spill during operation)								54
		Leak of fuel lines/tanks in basement of Bldg. 1 (No spill containment in Bldg. 1)							Vessel fueling procedure	56
		Spill during refueling a vessel							Replace flexible hoses annually	

Comments: Floating Dock - High risk
Road - Medium risk

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
8.9	Fire/explosion	Severe waves (pulling hose connection loose on Floating Dock) Spill/leak during refueling of underground storage tank (UST) (No spill containment in UST refueling area) (e.g., truck tank leak, tank hose leak/rupture, spill during operation) Leak of fuel lines/tanks in basement of Bldg. 1 (No spill containment in Bldg. 1) Spill during refueling a vessel	Fire/explosion (screened)	1	1	1	.000333		Fire extinguishers Shutoff valve for Floating Dock fuel line (can be closed during spill) Vessel fueling procedure Replace flexible hoses annually	53 54 56
Comments: Floating Dock - High risk Road - Medium risk										
8.10	Asphyxiant environment exposure		Screened							
Comments:										
8.11	Electrical hazards exposure		Screened							
Comments:										
8.12	High pressure materials exposure		Screened							
Comments:										
8.13	High noise exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
8.14	Excessive vibration exposure		Screened							
Comments:										
8.15	Radiation exposure		Screened							
Comments:										
8.16	Biological hazards exposure		Screened							
Comments:										
8.17	Hot/cold environments exposure		Screened							
Comments:										
8.18	Hot/cold surfaces/materials exposure	Physical contact with hot/cold surfaces/materials during LPG refueling operation	Hazardous exposure: cold environment/surface/material	0	0	4	.003033		PPE - gloves	
Comments: Bldg. 3 - High risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Drainage Services - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
9.1	Inadequate/no drainage system	Clogged catch basin Major storm	Screened						Multiple basins	
Comments:										
9.2	Caught in/ on/by/between		Screened							
Comments:										
9.3	Struck by/contact by		Screened							
Comments:										
9.4	Contact with/struck against		Screened							
Comments:										
9.5	Slip/trip/fall	Slick rocks during sampling of storm water	Screened							
Comments:										
9.6	Strain		Screened							
Comments:										
9.7	Toxic/corrosive/ reactive materials exposure	Spill of materials (e.g., fuel spills during refueling of UST; hazardous material spills during unloading from ship, in shops, or during fork truck transfer)	Hazardous exposure: Toxic/corrosive materials	1	4	5	.0603		Temporary dikes after a spill	9
Comments: Roads - High risk										
9.8	Fire/explosion		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
9.9	Asphyxiant environment exposure		Screened							
Comments:										
9.10	Electrical hazards exposure		Screened							
Comments:										
9.11	High pressure materials exposure		Screened							
Comments:										
9.12	High noise exposure		Screened							
Comments:										
9.13	Excessive vibration exposure		Screened							
Comments:										
9.14	Radiation exposure		Screened							
Comments:										
9.15	Biological hazards exposure		Screened							
Comments:										
9.16	Hot/cold environments exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
9.17	Hot/cold surfaces/materials exposure		Screened							

Comments:

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.1	Vehicle unavailable	Mechanical failures (preventive maintenance problems) Scheduling conflicts Equipment abuse by operators	Economic impact Hazardous exposure: contact injury (due to use of inappropriate equipment) Mission impact Equipment damage/loss (due to use of inappropriate equipment)	0	3	6	.30303		Scheduling to ensure availability Contracting services - mainly for cranes services Preventive maintenance system on powered equipment OSHA standard training on powered vehicles	1 2 10

Comments: Bldg. 3 (Facility Engineering), Roads, Magazine - Medium risk

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.2	Incorrect position, direction, power/speed	Equipment malfunction Pedestrian or base traffic forcing forklifts to swerve Untrained operators on forklifts USCG vehicle traffic forcing other traffic to swerve Large truck movement impacting other vehicles Ice buildup on roads/parking lots Inattention of safety observers during crane/forklift operations	Hazardous exposure: contact injury Equipment damage/loss	3	5	7	3.33		Strobe light on forklifts Checklist to ensure powered equipment operability prior to service Inherent design of controls makes it difficult for operator to confuse forward/reverse Hard hats Equipment has roll cage OSHA standard training for forklift operators Onbase moving citations for excessive speed Designated parking areas Low speed limit Multiple people can see vehicle accidents Snow plows and sand for roads/parking lots Safety observers for difficult crane/forklift operations	1 3 11 12 13 16 17 18 19 20

Comments: Bldg. 3 (Facility Engineering) - High risk
Roads. Magazine - Medium risk

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.3	Vehicle fails to maintain position	Equipment failure - brake failure, hydraulic failure Weather conditions Operator error - not securing brake, leaving in neutral, unfamiliarity with equipment, not lowering forklift forks when parking Improper selection of forklift for given load	Equipment damage/loss Person overboard Hazardous exposure: contact injury Hazardous exposure: toxic/corrosive materials	1	3	5	.0333		Chocking the tires Parking on a flat surface Preventive maintenance on braking and hydraulic systems Positioning the forks flat on the ground according to operator training (raised forks may impact something) Deicing agent laid down when ice builds up	1

Comments: Bldg. 3 (Facility Engineering) - High risk
Roads, Magazine - Medium risk

10.4	Caught in/ on/by/between		Screened							

Comments:

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.5	Struck by/contact by	Contractor vehicle impacts USCG/private vehicles Untrained operators Base traffic impacts powered equipment Safety observers fail to prevent other base traffic from impacting powered equipment Weather conditions	Hazardous exposure: contact injury Equipment damage/loss	2	4	5	.063		Forklifts have roll cages Deicing agents laid down when ice builds up OSHA standard training for powered equipment operators Speed limits and stop signs posted on base Safety observers prevent other vehicle traffic from entering the area Safety cones set up when needed Hard hats	8 14 3 5 7

Comments: Bldg. 3 (Facility Engineering) - High risk
Roads, Magazine - Medium risk

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.6	Slip/trip/fall	Personnel losing balance when climbing on/off forklifts Personnel tripping on raised forklift forks Weather conditions	Hazardous exposure: contact injury	2	4	5	.063		OSHA standard training for powered equipment operators Deicing agents laid down when ice builds up Nonskid strips placed on powered equipment Hard hats	5

Comments: Bldg. 3 (Facility Engineering) - High risk
Roads, Magazine - Medium risk

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.7	Strain		Screened							
Comments:										
10.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
10.9	Fire/explosion		Screened							
Comments:										
10.10	Asphyxiant environment exposure		Screened							
Comments:										
10.11	Electrical hazards exposure		Screened							
Comments:										
10.12	High pressure materials exposure		Screened							
Comments:										
10.13	High noise exposure		Screened							
Comments:										
10.14	Excessive vibration exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.15	Radiation exposure		Screened							
Comments:										
10.16	Biological hazards exposure		Screened							
Comments:										
10.17	Hot/cold environments exposure		Screened							
Comments:										
10.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
10.19	Contact with/struck against	Untrained operators running equipment into other objects	Hazardous exposure: contact injury	2	4	5	.063		Deicing agents laid down when ice builds up	1
										3
		Fatigued operators running equipment into other objects	Equipment damage/loss						OSHA standard training for powered equipment operators	6
		Safety observer does not prevent equipment from running into other objects	Hazardous exposure: electrical shock						Speed limits and stop signs posted on base	11
										12
		Base traffic parked where it should not be parked	Hazardous exposure: toxic/corrosive materials						Safety observers prevent other vehicle traffic from entering the area	13
		Weather conditions							Parking areas clearly marked on base	
		Personnel strike head on partially raised forks							Hard hats	
									Forklifts have roll cages	

Comments: Bldg. 3 (Facility Engineering) - High risk
Roads, Magazine - Medium risk

Table A.1 Course Hazard Analysis for ISC Seattle

Hand-operated Moving Equipment - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
11.1	Equipment unavailable		Screened							
Comments:										
11.2	Incorrect position, direction, power/speed		Screened							
Comments:										
11.3	Equipment fails to maintain position		Screened							
Comments:										
11.4	Caught in/ on/by/between		Screened							
Comments:										
11.5	Struck by/contact by		Screened							
Comments:										
11.6	Slip/trip/fall		Screened							
Comments:										
11.7	Strain	Lifting parts onto industrial tricycles Trying to keep a load on the hand-operated equipment while in transit	Hazardous exposure: contact injury	3	5	5	.36		Workplace safety training	
Comments: Bldg. 3 (Facility Engineering), Roads, Magazine - Medium risk										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
11.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
11.9	Fire/explosion		Screened							
Comments:										
11.10	Asphyxiant environment exposure		Screened							
Comments:										
11.11	Electrical hazards exposure		Screened							
Comments:										
11.12	High pressure materials exposure		Screened							
Comments:										
11.13	High noise exposure		Screened							
Comments:										
11.14	Excessive vibration exposure		Screened							
Comments:										
11.15	Radiation exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Hand-operated Moving Equipment - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
11.16	Biological hazards exposure		Screened							
Comments:										
11.17	Hot/cold environments exposure		Screened							
Comments:										
11.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
12.1	Lifting equipment unavailable		Screened							
Comments:										
12.2	Loss of support		Screened							
Comments:										
12.3	Incorrect load position, direction, speed	Operator fatigue results in incorrectly operating the crane Heavy/moderate winds can sway load Operator error in moving load	Screened	1	2	4	.0036		Lift planning for crane operations Crane operator school training (outside crane operators training people to Oregon standards) Training for USCG riggers as required Tag lines used in controlling load movement	4 15
Comments:										
12.4	Caught in/ on/by/between		Screened							
Comments:										
12.5	Struck by/contact by		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
12.6	Slip/trip/fall	Operator slips climbing into/out of crane cab	Screened	1	3	4	.0063		Crane operator school training (outside crane operators training people to Oregon standards) Hard hats Nonskid on crane foot surfaces	
Comments:										
12.7	Strain	Incorrect lifting to position component Lifting in tight spaces	Screened	1	3	4	.0063		Load lifting preplanning Workplace safety training	
Comments:										
12.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
12.9	Fire/explosion		Screened							
Comments:										
12.10	Asphyxiant environment exposure		Screened							
Comments:										
12.11	Electrical hazards exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Lifting Equipment - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
12.12	High pressure materials exposure		Screened							
Comments:										
12.13	High noise exposure		Screened							
Comments:										
12.14	Excessive vibration exposure		Screened							
Comments:										
12.15	Radiation exposure		Screened							
Comments:										
12.16	Biological hazards exposure		Screened							
Comments:										
12.17	Hot/cold environments exposure		Screened							
Comments:										
12.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Small Caliber Weapons and Other Weapons - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.1	Inoperable weapons		Screened							
Comments:										
13.2	Inadvertent firing	Operator error in not hearing/understanding the small arms instructor	Fire arm discharge	2	3	4	.009		Pacific Area training of small arms instructors	
		Small arms instructor gives incorrect firing order							Safety feature on the trigger	
		Hot gun barrel igniting a round							Personnel thoroughly briefed on listening to the small arms instructor	
									Weapons do not fire at a rate high enough to heat the barrel to the point of igniting a round	
Comments: Firing Range in Bldg. 7 - High risk										
13.3	Firing live ammunition instead of blanks	Small arms instructor error in using live ammunition	Fire arms discharge	2	3	4	.009		Dummy rounds have a physical hole in the casing so the rounds can be identified	
		Operator error in using live ammunition							Pacific Area training of small arms instructors	
Comments: Firing Range in Bldg. 7 - High risk										
13.4	Firing at the wrong target/position		Screened	1	1	1	.0000333			
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Small Caliber Weapons and Other Weapons - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.5	Caught in/ on/by/between		Screened	1	3	4	.0063			
Comments: Magazine issue										
13.6	Struck by/contact by		Screened							
Comments:										
13.7	Contact with/struck against		Screened	1	3	4	.0063			
Comments: Magazine issue										
13.8	Slip/trip/fall		Screened	1	3	4	.0063			
Comments: Magazine issue										
13.9	Strain	Strain when moving ammunition by hand	Hazardous exposure: contact injury	1	4	5	.0603		Workplace safety training	57
Comments: Armory, Magazine - Medium risk										
13.10	Toxic/corrosive/ reactive materials exposure		Screened	1	3	4	.0063			
Comments: Firing Range issue										
13.11	Fire/explosion		Screened	1	1	3	.00063			
Comments: Armory issue										

Table A.1 Course Hazard Analysis for ISC Seattle

Small Caliber Weapons and Other Weapons - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.12	Asphyxiant environment		Screened							
Comments:										
13.13	Electrical hazards exposure		Screened							
Comments:										
13.14	High pressure materials exposure		Screened							
Comments:										
13.15	High noise exposure		Screened	1	3	4	.0063			
Comments: Firing Range issue										
13.16	Excessive vibration exposure		N/A							
Comments:										
13.17	Radiation exposure		N/A							
Comments:										
13.18	Biological hazards exposure		Screened							
Comments:										
13.19	Hot/cold environments exposure		Screened						Magazine/Armory are ventilated	
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Small Caliber Weapons and Other Weapons - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
13.20	Hot/cold surfaces/materials exposure	An expended round lands on a person	Hazardous exposure: hot environment/surface/materials	1	3	5	.0333		Small arms instructor briefs personnel on thermal hazards	
Comments: Firing Range in Bldg. 7 - High risk										
13.21	Inadvertent actuation of non-firearm weapons (mace, stun gun, etc.)		Screened							
Comments:										
13.22	Incompatible materials		Screened							
Comments: Magazine and Armory issue										
13.23	Shipment has mixed materials		Screened							
Comments: Magazine issue										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
14.1	Inadequate/no recreation services		Not evaluated							
Comments:										
14.2	Recreation quality problem		Not evaluated							
Comments:										
14.3	Caught in/ on/by/between		Not evaluated							
Comments:										
14.4	Struck by/contact by		Not evaluated							
Comments:										
14.5	Contact with/struck against		Not evaluated							
Comments:										
14.6	Slip/trip/fall	Personnel lose footing while playing sports Uneven playing surfaces	Hazardous exposure: contact injury	2	5	5	.333		Playing by the rules Limiting personnel on playing courts Preventive maintenance on recreation facilities	
Comments: Recreation Center in Bldg. 3 - High risk										
14.7	Strain		Not evaluated							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
14.8	Toxic/corrosive/ reactive materials exposure		Not evaluated							
Comments:										
14.9	Fire/explosion		Not evaluated							
Comments:										
14.10	Asphyxiant environment exposure		Not evaluated							
Comments:										
14.11	Electrical hazards exposure		Not evaluated							
Comments:										
14.12	High pressure materials exposure		Not evaluated							
Comments:										
14.13	High noise exposure		Not evaluated							
Comments:										
14.14	Excessive vibration exposure		Not evaluated							
Comments:										
14.15	Radiation exposure		Not evaluated							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
14.16	Biological hazards exposure		Not evaluated							
Comments:										
14.17	Hot/cold environments exposure		Not evaluated							
Comments:										
14.18	Hot/cold surfaces/materials exposure		Not evaluated							
Comments:										

Table A.1 Course Hazard Analysis for ISC Scattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
15.1	Inadequate/no security services	Inadequate watchstander relief Unmonitored fencing security Unmonitored cameras	Equipment damage/loss Hazardous exposure: contact injury	1	3	5	.0333		Camera monitoring ISC duty section has security watch standers Gate security is a contracted service Crisis locker is available for emergency supplies	58
Comments:										
15.2	Security services quality problem (see Inadequate/no security services)		Screened							
Comments:										
15.3	Caught in/ on/by/between		Screened							
Comments:										
15.4	Struck by/contact by		Screened							
Comments:										
15.5	Contact with/struck against		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
15.6	Slip/trip/fall	Slip/trip/fall during security inspections Pursuing perpetrators	Hazardous exposure: contact injury	1	3	5	.0333		Pursuing perpetrators not often performed	
Comments:										
15.7	Strain		Screened							
Comments:										
15.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
15.9	Fire/explosion		Screened							
Comments:										
15.10	Asphyxiant environment exposure		Screened							
Comments:										
15.11	Electrical hazards exposure		Screened							
Comments:										
15.12	High pressure materials exposure		N/A							
Comments:										
15.13	High noise exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
15.14	Excessive vibration exposure		N/A							
Comments:										
15.15	Radiation exposure		N/A							
Comments:										
15.16	Biological hazards exposure		Screened							
Comments:										
15.17	Hot/cold environments exposure		Screened							
Comments:										
15.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.1	System/equipment unavailable		Screened							
Comments:										
16.2	Poor quality products, services, or operations	Turnover rate Defective materials	Hazardous exposure: contact injury Equipment damage/loss Mission impact	4	4	5	.36		Supervision of tasks Standard procedures Formalized lessons-learned work histories for standard jobs Formalized work order system with detailed instructions, work history, procurements	49
Comments: Bldg. 3 (NESU) - High risk										
16.3	Caught in/ on/by/between	Misoperation of equipment Malfunction of equipment	Hazardous exposure: contact injury	1	3	5	.0333		Machine guards	
Comments: Bldg. 3 (NESU) - High risk										
16.4	Struck by/contact by		Screened							
Comments:										
16.5	Contact with/struck against	Misoperation of equipment Malfunction of equipment	Hazardous exposure: contact injury	1	2	5	.0306		Machine guards	
Comments: Bldg. 3 (NESU) - High risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Industrial Systems/Equipment (NESU) - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.6	Slip/trip/fall	Slick floor (e.g., oil, cleaning fluids, grease) Equipment/materials in pathways	Hazardous exposure: contact injury	1	2	5	.0306		Housekeeping policy	5
Comments: Bldg. 3 (NESU) - High risk										
16.7	Strain	Misoperation of portable equipment Overexertion during task	Hazardous exposure: contact injury	1	2	5	.0306		Shop training on good work practices	
Comments: Bldg. 3 (NESU) - High risk										
16.8	Toxic/corrosive/ reactive materials exposure	Exposure to chemical cleaning system Welding on some materials (galvanized pipe, etc.) Inhalation of metal dust Solvents Bead blaster	Screened						PPE - respirators, gloves, face shields	
Comments:										
16.9	Fire/explosion	Solvents Welding	Screened	1	2	3	.0009		Paint locker Fire extinguishers Fire alarms	
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Industrial Systems/Equipment (NESU) - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.10	Asphyxiant environment exposure	Forktruck exhaust	Screened							
Comments:										
16.11	Electrical hazards exposure		Screened	1	2	3	.0009		Lockout/tagout	
Comments:										
16.12	High pressure materials exposure		Screened							
Comments:										
16.13	High noise exposure		Screened							
Comments:										
16.14	Excessive vibration exposure		Screened							
Comments:										
16.15	Radiation exposure		Screened							
Comments:										
16.16	Biological hazards exposure		Screened							
Comments:										
16.17	Hot/cold environments exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
16.18	Hot/cold surfaces/materials exposure	Welding	Screened							

Comments:

Table A.1 Course Hazard Analysis for ISC Seattle

Compressed Gas Services - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.1	Inadequate/no compressed gases		Screened							
Comments:										
17.2	Compressed gas quality problem		Screened							
Comments:										
17.3	Caught in/ on/by/between		Screened							
Comments:										
17.4	Struck by/contact by		Screened							
Comments:										
17.5	Contact with/struck against		Screened							
Comments:										
17.6	Slip/trip/fall		Screened							
Comments:										
17.7	Strain		Screened							
Comments:										
17.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Compressed Gas Services - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.9	Fire/explosion	Dropping bottle Leaks/valve failure/valve left open Hose leaks	Screened	1			.0003033		Hoses periodically inspected/replaced Designated storage area	
Comments:										
17.10	Asphyxiant environment exposure		Screened							
Comments:										
17.11	Electrical hazards exposure		Screened							
Comments:										
17.12	High pressure materials exposure		Screened							
Comments:										
17.13	High noise exposure		Screened							
Comments:										
17.14	Excessive vibration exposure		Screened							
Comments:										
17.15	Radiation exposure		Screened							
Comments:										
17.16	Biological hazards exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
17.17	Hot/cold environments exposure		Screened							
Comments:										
17.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
18.1	Inadequate/no compressed air		Screened							
Comments:										
18.2	Compressed air quality problem		Screened							
Comments:										
18.3	Caught in/ on/by/between		Screened							
Comments:										
18.4	Struck by/contact by		Screened							
Comments:										
18.5	Contact with/struck against		Screened							
Comments:										
18.6	Slip/trip/fall		Screened							
Comments:										
18.7	Strain		Screened							
Comments:										
18.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
18.9	Fire/explosion		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
18.10	Asphyxiant environment exposure		Screened							
Comments:										
18.11	Electrical hazards exposure		Screened							
Comments:										
18.12	High pressure materials exposure	Cleaning parts	Screened							
Comments:										
18.13	High noise exposure		Screened							
Comments:										
18.14	Excessive vibration exposure		Screened							
Comments:										
18.15	Radiation exposure		Screened							
Comments:										
18.16	Biological hazards exposure		Screened							
Comments:										
18.17	Hot/cold environments exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Compressed Air Services - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
18.18	Hot/cold surfaces/materials exposure		Screened							

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
19.1	Inadequate/no administrative services		Screened							
Comments:										
19.2	Administrative services quality problem		Screened							
Comments:										
19.3	Caught in/ on/by/between		Screened							
Comments:										
19.4	Struck by/contact by		Screened							
Comments:										
19.5	Contact with/struck against		Screened							
Comments:										
19.6	Slip/trip/fall		Screened							
Comments:										
19.7	Strain		Screened							
Comments:										
19.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
19.9	Fire/explosion		Screened							
Comments:										
19.10	Asphyxiant environment exposure		Screened							
Comments:										
19.11	Electrical hazards exposure	Power cords	Screened							
Comments:										
19.12	High pressure materials exposure		Screened							
Comments:										
19.13	High noise exposure		Screened							
Comments:										
19.14	Excessive vibration exposure		Screened							
Comments:										
19.15	Radiation exposure		Screened							
Comments:										
19.16	Biological hazards exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
19.17	Hot/cold environments exposure		Screened							
Comments:										
19.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.1	Vehicle unavailable	Mechanical failures (preventive maintenance problems)	Economic impact	0	3	6	.30303		Scheduling to ensure availability	1
		Scheduling conflicts	Equipment damage/loss (due to use of inappropriate equipment)						Contacting services - mainly for cranes services	2 10
		Equipment abuse by operators	Mission impact						Preventive maintenance system on powered equipment	
			Hazardous exposure: contact injury (due to use of inappropriate equipment)						OSHA standard training on powered vehicles	

Comments: Bldgs. 3, 7 - Medium risk
HAZMAT Storage - Low risk

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.2	Incorrect position, direction, power/speed	Equipment malfunction	Hazardous exposure: contact injury	3	5	7	3.33		Inherent design of controls makes it difficult for operator to confuse forward/reverse	1 3
		Pedestrian traffic forcing the forklift to swerve	Equipment damage/loss						Hard hats	6
		Untrained operators	Environmental - spill a load of batteries						Forklifts have roll cages	7
		Other forklift traffic forcing the forklift to swerve							Strobe light on forklifts. Audio warning when in reverse	8 11
									OSHA standard training on powered vehicles	13
									Checklist to ensure powered vehicle operability prior to service	

Comments: Bldg. 7 - High risk
Bldg. 3 - Medium risk
HAZMAT Storage - Low risk

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.3	Vehicle fails to maintain position	Equipment failure - brake failure, hydraulic failure	Hazardous exposure: contact injury	1	3	5	.0333		Chocking the tires	1
		Operator error in not setting brake	Equipment damage/loss						Preventive maintenance on braking and hydraulic systems	11
		Improper selection of forklift for given load							Positioning the forks flat on the ground according to operator training (raised forks may impact something)	13
Comments: Bldg. 7, HAZMAT Storage - Medium risk										
20.4	Caught in/ on/by/between		Screened							
Comments:										
20.5	Struck by/contact by	Stacked loads fall onto forklift after bumping into it	Hazardous exposure: contact injury	2	4	5	.063		Designating the work area by setting up cones	7
										8
		Improperly stacked load falls on forklift when lifting it	Equipment damage/loss						OSHA standard training for powered equipment operators	3
		Improper lighting causing poor visibility	Hazardous exposure: toxic/corrosive materials						Safety observers prevent other traffic from entering the area	5
		Personnel struck by passing forklifts							Hard hats	
									Forklifts have roll cages	
Comments: Bldg. 7, HAZMAT Storage - Medium risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.6	Slip/trip/fall	Personnel losing balance when climbing on/off forklifts	Hazardous exposure: contact injury	2	4	5	.063		OSHA standard training for powered equipment operators Nonskid strips placed on powered equipment Hard hats	5
Comments: Bldg. 7, HAZMAT Storage - Medium risk										
20.7	Strain		Screened							
Comments:										
20.8	Toxic/corrosive/ reactive materials exposure	Improper materials stored in buildings	Hazardous exposure: toxic/corrosive materials	2	3	4	.009		ISC HAZMAT Storage program is actively enforced Operators enrolled in Occupational Medical Monitoring Program - no issues to date	9
Comments: HAZMAT Storage - High risk Bldg. 7 - Medium risk										
20.9	Fire/explosion		Screened						Yearly fire inspections with Seattle Fire Department	
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.10	Asphyxiant environment exposure		Screened							
Comments:										
20.11	Electrical hazards exposure		Screened							
Comments:										
20.12	High pressure materials exposure	Dropping CO2 fire extinguishers while in transit	Hazardous exposure: contact injury	2	3	4	.009		Load is strapped in place prior to movement	
			Screened							
Comments: Bldg. 7, HAZMAT Storage - Medium risk										
20.13	High noise exposure		Screened	0	2	3	.00063		Frequent noise surveys do not indicate issues in the buildings Operators enrolled in Occupational Medical Monitoring Program - no issues to date	
Comments:										
20.14	Excessive vibration exposure		N/A							
Comments:										
20.15	Radiation exposure		N/A							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
20.16	Biological hazards exposure		Screened							
Comments:										
20.17	Hot/cold environments exposure		Screened							
Comments:										
20.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										
20.19	Contact with/struck against	Untrained operators running equipment into other objects	Hazardous exposure: contact injury	2	4	5	.063		OSHA standard training for powered equipment operators	1
										3
		Fatigued operators running equipment into other objects	Hazardous exposure: electrical shock						Safety observers prevent other vehicle traffic from entering the area	6
		Safety observer does not prevent equipment from running into other objects	Hazardous exposure: toxic/corrosive materials						Hard hats	11
										13
		Personnel strike head on partially raised forks	Equipment damage/loss						Equipment has roll cage	

Comments: Bldg. 7, HAZMAT Storage - Medium risk

Table A.1 Course Hazard Analysis for ISC Seattle

Hand-operated Moving Equipment - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
21.1	Equipment unavailable		Screened							
Comments:										
21.2	Incorrect position, direction, power/speed		Screened							
Comments:										
21.3	Equipment fails to maintain position		Screened							
Comments:										
21.4	Caught in/ on/by/between		Screened							
Comments:										
21.5	Struck by/contact by		Screened							
Comments:										
21.6	Slip/trip/fall		Screened							
Comments:										
21.7	Strain	Lifting parts onto industrial tricycles Trying to keep a load on the hand-operated equipment while in transit	Hazardous exposure: contact injury	3	5	5	.36		Workplace safety training	
Comments: Bldg. 7, HAZMAT Storage - Medium risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Hand-operated Moving Equipment - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
21.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
21.9	Fire/explosion		Screened							
Comments:										
21.10	Asphyxiant environment exposure		Screened							
Comments:										
21.11	Electrical hazards exposure		Screened							
Comments:										
21.12	High pressure materials exposure		Screened							
Comments:										
21.13	High noise exposure		Screened							
Comments:										
21.14	Excessive vibration exposure		Screened							
Comments:										
21.15	Radiation exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
21.16	Biological hazards exposure		Screened							
Comments:										
21.17	Hot/cold environments exposure		Screened							
Comments:										
21.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
22.1	Lifting equipment unavailable		Screened							
Comments:										
22.2	Loss of support	Mechanical failure of support where lifting device is fastened Incorrect operation of lifting equipment Mechanical failure of lifting device Inadequate rigging of object to be lifted	Equipment damage/loss Hazardous exposure: contact injury	2	4	4	.036		Annual weight test of slings and lifting devices PPE - steel-toed shoes	
Comments: NESU (vessels activities) - High risk NESU (shop activities) - Medium risk Bldg. 7, HAZMAT Storage - Low risk										
22.3	Incorrect load position, direction, speed	Operator fatigue causing incorrect operation of the crane Operator error in moving load	Screened	1	2	4	.0036		Lift planning for crane operations Crane operator school training (outside crane operators training people to Oregon standards) Training for USCG riggers as required Tag lines used in controlling load movement	
Comments: Bldg. 7, NESU (vessel activities) - Medium risk HAZMAT Storage - Low risk										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
22.4	Caught in/ on/by/between	Movement of object (setting object on hand, foot) Incorrect installation of slings, belly bands Incorrect operation of chainfalls, come-alongs	Hazardous exposure: contact injury - crushed hand, foot, etc.	1	4	6	.3303		PPE - gloves, steel-toed shoes	3
Comments: NESU (vessel activities) - High risk NESU (shop activities) - Medium risk Bldg. 7, HAZMAT Storage - Low risk										
22.5	Struck by/contact by		Screened							
Comments:										
22.6	Slip/trip/fall	Operator slips climbing into/out of crane cab	Screened	1	3	4	.0063		Crane operator school training (outside crane operators training people to Oregon standards) Hard hats Nonskid on crane foot surfaces	
Comments: Risk equally divided among Bldg. 7, NESU (vessel activities), and HAZMAT Storage										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
22.7	Strain	Incorrect lift Lifting in tight spaces	Hazardous exposure: contact injury	2	5	6	.603		Load lifting preplanning Workplace safety training Lifting belts	
Comments: NESU (vessel activities) - High risk NESU (shop activities) - Medium risk Bldg. 7, HAZMAT Storage - Low risk										
22.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
22.9	Fire/explosion		Screened							
Comments:										
22.10	Asphyxiant environment exposure		Screened							
Comments:										
22.11	Electrical hazards exposure		Screened							
Comments:										
22.12	High pressure materials exposure		Screened							
Comments:										
22.13	High noise exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
22.14	Excessive vibration exposure		Screened							
Comments:										
22.15	Radiation exposure		Screened							
Comments:										
22.16	Biological hazards exposure		Screened							
Comments:										
22.17	Hot/cold environments exposure		Screened							
Comments:										
22.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
23.1	Inadequate/no warehousing service		Screened (Economic - can request expedited HAZMAT cleanup/pickup from offsite source)						Flexibility in responding to excessive HAZMAT loads by establishing alternative sites on base	
Comments: HAZMAT Storage - High risk										
23.2	Warehousing quality problem		N/A							
Comments:										
23.3	Caught in/ on/by/between		Screened							
Comments:										
23.4	Struck by/contact by		Screened							
Comments:										
23.5	Contact with/struck against		Screened							
Comments:										
23.6	Slip/trip/fall	Wooden slats used for shelving can fall	Equipment damage/loss	0	3	5	.03303			33
Comments: Bldg. 3 - High risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Warehousing Services - Industrial Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
23.7	Strain	Loading/unloading HAZMAT in/out of HAZMAT bins or on pier	Hazardous exposure: contact injury	1	5	5	.3303		Forklift used for heavier loads Customers package HAZMAT for shipping to storage - no physical packing by HAZMAT crew Storage bins located near ground level Ramp available for storing HAZMAT in bins Workplace safety training	

Comments: HAZMAT Storage - High risk
Bldg. 3 - Medium risk

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
23.8	Toxic/corrosive/ reactive materials exposure	Spill of paints/solvents in Bldgs. 3 and 7 HAZMAT improperly packaged Dropping HAZMAT while moving it Small releases during handling operations Seismic event releasing HAZMAT Mixing incompatible HAZMAT	Screened	0	3	4	.00603		HAZMAT packages inspected by HAZMAT team and by offsite storage receivers HAZMAT activity done in open air area Respirators used when needed Paint lockers available to store HAZMAT for industrial use Material safety data sheets available for hazard communication Actual HAZMAT quantities are limited	

Comments: HAZMAT Storage - High risk
Bldgs. 3, 7 - Medium risk

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
23.9	Fire/explosion	HAZMAT improperly packaged by customers Mixing incompatible HAZMAT Inadvertent smoking near HAZMAT (especially contaminated diesel/gas)	Screened	1	3	4	.0063		HAZMAT packages inspected by HAZMAT team and by offsite storage receivers Dedicated flammable storage bins Fire extinguishers located in HAZMAT Storage area No-smoking policy in HAZMAT area	
Comments: HAZMAT Storage - High risk										
23.10	Asphyxiant environment exposure		Screened						Storage bins are ventilated HAZMAT activity done in open air area No asphyxiant material expected	
Comments: HAZMAT Storage - High risk										
23.11	Electrical hazards exposure		Screened							
Comments:										
23.12	High pressure materials exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
23.13	High noise exposure		Screened							
Comments:										
23.14	Excessive vibration exposure		N/A							
Comments:										
23.15	Radiation exposure		N/A							
Comments:										
23.16	Biological hazards exposure		Screened							
Comments:										
23.17	Hot/cold environments exposure		Screened							
Comments:										
23.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Structures (Buildings, Piers, Vessels, Craft) - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
24.1	Excessive static structural loading	Vehicle disregard for load limit diagram (e.g., cranes, contractors equipment/operations, truck) Equipment from vessel placed on weak area by crane Crane and load exceeding load limit	Equipment damage/loss - collapse of pier, equipment damage Interruption of mission - rent offbase space; vessel mission may be delayed Hazardous exposure: contact injury	4	5	5	.63		Load limit diagram and communication of load limits Guards control access to base and remind people of load limits Facility engineer periodically surveys vehicle traffic	24

Comments: Pier 36 - High risk
Pier 37 - Medium risk

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
24.2	Excessive dynamic structural loading	Vessel collision Vehicle collision Seismic event Tsunami, severe weather wave Heavy wave action (wind and waves) Mooring of boats Vessel moving along the pier using capstans (high load on fixed point of pier)	Equipment damage/loss - collapse of pier, equipment damage Interruption of mission - rent offbase space; vessel mission may be delayed Hazardous exposure: contact injury	4	4	4	.333		Pier 37 and apron (15% over design for impact)	22 34

Comments: Pier 36 - High risk
Floating Dock - Medium risk
Pier 37 - Low risk

Table A.1 Course Hazard Analysis for ISC Seattle

Structures (Buildings, Piers, Vessels, Craft) - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
24.3	Structural degradation	Age (increased rate of degradation of piles) Mischaracterization of existing problems (inspections may have mischaracterized the problems) Worms or animals eating piles	Equipment damage/loss - collapse of pier, equipment damage Interruption of mission - rent offbase space; vessel mission may be delayed Hazardous exposure: contact injury	4	4	4	.333		Periodic inspection of Pier 36 Periodic replacement of piles (Pier 36) Creosote soaking of piles (Pier 36)	21 23
Comments: Pier 36 - High risk Floating Dock - Medium risk Pier 37 - Low risk										
24.4	Caught in/ on/by/between	Wake pushing boat into dock, camel (during maintenance, inspection) Movement of floating dock Opening and closing hatches	Hazardous exposure: hand caught in floating dock movement, piling assembly	2	4	5	.063		Shop training on good work practices	22
Comments: Floating Dock - High risk Piers 36, 37 - Low risk										
24.5	Struck by/contact by		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Structures (Buildings, Piers, Vessels, Craft) - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
24.6	Slip/trip/fall	Steel plates covering weak areas on the pier	Hazardous exposure: contact injury	2	4	5	.063		PPE - lifejackets, hardhats	5
		Uneven surface due to settlement (bad roads)								41
		Slick substance on the pier (e.g., oil, ice)								
		Wave (person overboard during maintenance)								
		Structures on the piers and docks								
Comments: Piers 36, 37; Floating Dock - Medium risk										
24.7	Strain	Lifting hatch	Screened	1	3	4	.0063			
Comments: Piers 36, 37; Floating Dock - Medium risk										
24.8	Toxic/corrosive/ reactive materials exposure	Lead, DDT in sediment	Screened						PPE - heavy clothes, gloves	
		Creosote								
		Dust from concrete work								
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Structures (Buildings, Piers, Vessels, Craft) - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
24.9	Fire/explosion	Marine accident (oil spill and fire) Hot work on pier Electrical short Combustible solids allowed to collect and ignite	Equipment damage/loss	2	2	2	.00333		Fire watches for hot work Sprinkler system for Pier 36 (questionable operation)	39
Comments: Pier 36 - High risk Floating Dock - Medium risk Pier 37 - Low risk										
24.10	Asphyxiant environment exposure		Screened - areas under piers are confined spaces							
Comments:										
24.11	Electrical hazards exposure		Screened							
Comments:										
24.12	High pressure materials exposure		Screened							
Comments:										
24.13	High noise exposure	Driving piles (contractors mainly)	Screened							
Comments:										
24.14	Excessive vibration exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
24.15	Radiation exposure		Screened							
Comments:										
24.16	Biological hazards exposure		Screened							
Comments:										
24.17	Hot/cold environments exposure		Screened							
Comments:										
24.18	Hot/cold surfaces/materials exposure	Welding/cutting	Hazardous exposure: hot environment/surface/material	1	3	5	.0333		PPE - gloves, clothing	
Comments: Piers 36, 37; Floating Dock - Medium risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.1	Vehicle unavailable	Mechanical failures (preventive maintenance problems) Scheduling conflicts Equipment abuse by operators	Economic impact Hazardous exposure: contact injury (due to use of inappropriate equipment) Mission impact Equipment damage/loss (due to use of inappropriate equipment)	0	3	6	.30303		Scheduling to ensure availability Contracting services - mainly for cranes services Preventive maintenance system on powered equipment OSHA standard training on powered vehicles	1 2 10

Comments: Piers 36, 37 - Medium risk

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.2	Incorrect position, direction, power/speed	Untrained operators Icy pier conditions Equipment malfunction Base traffic forcing powered vehicles to swerve	Hazardous exposure: toxic/corrosive materials Hazardous exposure: electrical shock Environmental - battery load spill Hazardous exposure: contact injury Person overboard Equipment damage/loss	3	5	7	3.33		OSHA standard training on powered vehicles Deicing agent for icy piers Checklist to ensure powered equipment operability prior to service Inherent design of controls makes it difficult for operator to confuse forward/reverse Traffic cones to redirect traffic away from powered equipment operations Hard hats Forklifts have roll cages	1 7 8 11 12 13

Comments: Pier 36 - High risk
Pier 37 - Medium risk

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.3	Vehicle fails to maintain position	Equipment failure - brake failure, hydraulic failure Icy conditions Operator error - not securing brake, leaving in neutral, unfamiliarity with equipment specifics, not lowering forklift forks when parking Improper selection of forklift for given load	Equipment damage/loss Person overboard Hazardous exposure: contact injury Hazardous exposure: toxic/corrosive materials Hazardous exposure: electrical shock	3	5	5	.36		Parking brake positioning Chocking the tires Parking on a flat surface Preventive maintenance on braking and hydraulic systems Positioning the forks flat on the ground according to operator training (raised forks may impact something)	1

Comments: Pier 36 - High risk
Pier 37 - Medium risk

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.4	Caught in/ on/by/between	Base traffic traps operator against equipment Operator gets caught on forklift while checking it as it operates	Screened No accessible rotating equipment							

Comments:

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.5	Struck by/contact by	Untrained operators jeopardizing safety of powered equipment Base traffic impacts powered equipment Safety observers fail to prevent other base traffic from impacting powered equipment Weather conditions	Hazardous exposure: contact injury	4	4	4	.333		OSHA standard training for powered equipment operators Speed limits and stop signs posted on base Safety observers prevent other vehicle traffic from entering the area Hard hats Equipment has roll cage Deicing agents laid down when ice builds up	14 5 8
Comments: Piers 36, 37 - Medium risk										
25.6	Slip/trip/fall	Personnel tripping on raised forklift forks Operators climbing on/off powered equipment Weather conditions	Hazardous exposure: contact injury	2	4	5	.063		OSHA standard training for powered equipment operators Deicing agents laid down when ice builds up Nonskid strips placed on powered equipment Hard hats	5
Comments: Piers 36, 37 - Medium risk										
25.7	Strain		Screened	1	3	4	.0063			
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.8	Toxic/corrosive/ reactive materials exposure		Hazardous exposure: toxic/corrosive materials Screened							
Comments:										
25.9	Fire/explosion		Screened							
Comments:										
25.10	Asphyxiant environment exposure		Screened							
Comments:										
25.11	Electrical hazards exposure		Screened							
Comments:										
25.12	High pressure materials exposure		Screened							
Comments:										
25.13	High noise exposure		Screened							
Comments:										
25.14	Excessive vibration exposure		Screened							
Comments:										
25.15	Radiation exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.16	Biological hazards exposure		Screened							
Comments:										
25.17	Hot/cold environments exposure		Screened						Seattle weather does not change significantly	
Comments:										
25.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Powered Vehicles - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
25.19	Contact with/struck against	Untrained operators running equipment into other objects	Hazardous exposure: contact injury	3	5	7	3.33		Deicing agents laid down when ice builds up	11
							.0000333			12
		Fatigued operators running equipment into other objects	Hazardous exposure: electrical shock						OSHA standard training for powered equipment operators	13
		Safety observer does not prevent equipment from running into other objects	Hazardous exposure: toxic/corrosive materials						Speed limits and stop signs posted on base	1
										6
			Equipment damage/loss						Safety observers prevent other vehicle traffic from entering the area	
		Base traffic parked where it should not be parked								
		Weather conditions							Parking areas clearly marked on base	
		Personnel strike head on partially raised forks							Hard hats	
									Equipment has roll cage	

Comments: Pier 36 - High risk
Pier 37 - Medium risk

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
26.1	Equipment unavailable		Screened							
Comments:										
26.2	Incorrect position, direction, power/speed		Screened							
Comments:										
26.3	Equipment fails to maintain position		Screened							
Comments:										
26.4	Caught in/ on/by/between		Screened							
Comments:										
26.5	Struck by/contact by		Screened							
Comments:										
26.6	Slip/trip/fall		Screened							
Comments:										
26.7	Strain	Lifting parts onto industrial tricycles Trying to keep a load on the hand-operated equipment while in transit	Hazardous exposure: contact injury	1	4	6	.3303		Dollies not often used for pier services	
Comments: Piers 36, 37; Floating Dock - Medium risk										

Table A.1 Course Hazard Analysis for ISC Seattle

Hand-operated Moving Equipment - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
26.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
26.9	Fire/explosion		Screened							
Comments:										
26.10	Asphyxiant environment exposure		Screened							
Comments:										
26.11	Electrical hazards exposure		Screened							
Comments:										
26.12	High pressure materials exposure		Screened							
Comments:										
26.13	High noise exposure		Screened							
Comments:										
26.14	Excessive vibration exposure		Screened							
Comments:										
26.15	Radiation exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
26.16	Biological hazards exposure		Screened							
Comments:										
26.17	Hot/cold environments exposure		Screened							
Comments:										
26.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
27.1	Lifting equipment unavailable	Unavailability of personnel - scheduling conflict	Screened						Contracting services for offbase support	
Comments:										
27.2	Loss of support		Screened							
Comments:										
27.3	Incorrect load position, direction, speed	Operator fatigue causes incorrect operation of the crane	Hazardous exposure: contact injury	2	3	5	.036		Lift planning for crane operations	4
		Heavy/moderate winds can sway load	Equipment damage/loss						Crane operator school training (outside crane operators training people to Oregon standards)	15
		Operator error in moving load	Person overboard						Training for USCG riggers as required	
									Tag lines used in controlling load movement	
Comments: Piers 36, 37; Floating Dock - Medium risk										
27.4	Caught in/ on/by/between		Screened							
Comments:										
27.5	Struck by/contact by		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Lifting Equipment - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
27.6	Slip/trip/fall	Crane hook swings back into crane cab Operator slips while climbing into/out of crane cab	Hazardous exposure: contact injury Equipment damage/loss	2	4	5	.063		Crane operator school training (outside crane operators training people to Oregon standards) Hard hats Nonskid on crane foot surfaces	5
Comments: Piers 36, 37; Floating Dock - Medium risk										
27.7	Strain		Screened							
Comments:										
27.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
27.9	Fire/explosion		Screened							
Comments:										
27.10	Asphyxiant environment exposure		Screened							
Comments:										
27.11	Electrical hazards exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Lifting Equipment - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
27.12	High pressure materials exposure		Screened							
Comments:										
27.13	High noise exposure		Screened							
Comments:										
27.14	Excessive vibration exposure		Screened							
Comments:										
27.15	Radiation exposure		Screened							
Comments:										
27.16	Biological hazards exposure		Screened							
Comments:										
27.17	Hot/cold environments exposure		Screened							
Comments:										
27.18	Hot/cold surfaces/materials exposure		Screened							
Comments:										
27.19	Contact with/struck against		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Small Caliber Weapons and Other Weapons - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
28.1	Inoperable weapons		N/A							
Comments:										
28.2	Inadvertent firing		N/A							
Comments:										
28.3	Firing live ammunition instead of blanks		N/A							
Comments:										
28.4	Firing at the wrong target/position		N/A							
Comments:										
28.5	Caught in/ on/by/between		Screened							
Comments:										
28.6	Struck by/contact by		Screened							
Comments:										
28.7	Contact with/struck against		Screened							
Comments:										
28.8	Slip/trip/fall		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
28.9	Strain	Strain while loading/unloading ammunition on/off the truck	Hazardous exposure: contact injury - strain	1	3	5	.0333		USCG requirement for no concurrent operations while ammunition is being loaded Multiple personnel involved in loading/unloading operations Supervision while loading/unloading ammunition Two-person rule for higher weight containers Workplace safety training	55 57
Comments: Piers 36, 37; Floating Dock - Medium risk										
28.10	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
28.11	Fire/explosion		Screened						Only a small amount of highly explosive 25mm ammunition has been loaded in the past Emission control set for loading ammunition	
Comments:										
28.12	Asphyxiant environment		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
28.13	Electrical hazards exposure		Screened							
Comments:										
28.14	High pressure materials exposure		Screened							
Comments:										
28.15	High noise exposure		Screened							
Comments:										
28.16	Excessive vibration exposure		Screened							
Comments:										
28.17	Radiation exposure		Screened						Emission control set for ammunition loading operations	
Comments:										
28.18	Biological hazards exposure		Screened							
Comments:										
28.19	Hot/cold environments exposure		Screened							
Comments:										
28.20	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Small Caliber Weapons and Other Weapons - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
28.21	Inadvertent actuation of non-firearm weapons (mace, stun gun, etc.)		N/A							

Comments:

Table A.1 Course Hazard Analysis for ISC Seattle

Trash Removal Services - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
29.1	Inadequate/no trash removal	Unenforced trash removal policies	Environmental impact	1	4	4	.0333		Feedback from vessels in port when trash removal is inadequate	
Comments: Piers 36, 37; Floating Dock - Medium risk										
29.2	Caught in/ on/by/between		Screened							
Comments:										
29.3	Struck by/contact by		Screened							
Comments:										
29.4	Contact with/struck against		Screened							
Comments:										
29.5	Slip/trip/fall		Screened							
Comments:										
29.6	Strain	Personnel individually handling too much of a trash load	Hazardous exposure: contact injury - strain	1	3	6	.3033		Multiple personnel involved in handling trash Workplace safety training	
Comments: Piers 36, 37; Floating Dock - Medium risk										
29.7	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Trash Removal Services - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
29.8	Fire/explosion		Screened							
Comments:										
29.9	Asphyxiant environment exposure		Screened							
Comments:										
29.10	Electrical hazards exposure		Screened							
Comments:										
29.11	High pressure materials exposure		Screened							
Comments:										
29.12	High noise exposure		Screened							
Comments:										
29.13	Excessive vibration exposure		Screened							
Comments:										
29.14	Radiation exposure		Screened							
Comments:										
29.15	Biological hazards exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Trash Removal Services - Pier Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
29.16	Hot/cold environments exposure		Screened							
Comments:										
29.17	Hot/cold surfaces/materials exposure		Screened							
Comments:										

Table A.1 Course Hazard Analysis for ISC Seattle

Sewage Services - Base Services

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
30.1	Inadequate/no sewage services	Sewage system failure - lift station failure, spilling sewage onto street Sewage system failure - no sewage availability	Hazardous exposure: biological materials Environmental impact - largest concern Economic - require contract services	1	6	6	3.3003		Preventive maintenance on lift stations Alarms on sewage overflow	
Comments: Piers 36, 37, Floating Dock - Medium risk										
30.2	Effluent quality problem		Screened							
Comments:										
30.3	Caught in/ on/by/between		Screened							
Comments:										
30.4	Struck by/contact by		Screened							
Comments:										
30.5	Contact with/struck against		Screened							
Comments:										
30.6	Slip/trip/fall		Screened							
Comments:										
30.7	Strain	Strain during maintenance	Hazardous exposure: contact injury - maintenance issue	1	3	5	.0333		Job site preplanning	
Comments: Piers 36, 37; Floating Dock - Medium risk										

Table A.1 Course Hazard Analysis for ISC Seattle

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
30.8	Toxic/corrosive/ reactive materials exposure		Screened							
Comments:										
30.9	Fire/explosion		Screened							
Comments:										
30.10	Asphyxiant environment exposure		Screened						Established confined space entry procedure for lift station entry	
Comments:										
30.11	Electrical hazards exposure		Screened							
Comments:										
30.12	High pressure materials exposure		Screened							
Comments:										
30.13	High noise exposure		Screened							
Comments:										
30.14	Excessive vibration exposure		Screened							
Comments:										
30.15	Radiation exposure		Screened							
Comments:										

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
30.16	Biological hazards exposure	Maintenance on the sewage system Lift station malfunction	Hazardous exposure: biological materials - hepatitis	1	4	4	.0333		Personnel wearing PPE	48

Comments: Piers 36, 37; Floating Dock - Medium risk

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
30.17	Hot/cold environments exposure									

Comments:

No.	Deviation	Most Significant Causes	Potential Mishap Types	A/B	C	D	RIN	CERT	Safeguards	Recs
30.18	Hot/cold surfaces/materials exposure									

Comments:

ATTACHMENT B

COARSE HAZARD ANALYSIS RECOMMENDATIONS RISK REDUCTION ESTIMATES

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 1 —Consider dedicating full-time personnel to forklift operations	*Powered vehicles (Pier Services)* Vehicle unavailable	0.30 (0,3,6)				
	Powered vehicles (Pier Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Pier Services) Vehicle fails to maintain position	0.36 (3,5,5)				
	Powered vehicles (Pier Services) Contact with/struck against	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Vehicle unavailable	0.30 (0,3,6)				
	Powered vehicles (Industrial Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Vehicle fails to maintain position	0.03 (1,3,5)				
	Powered vehicles (Industrial Services) Contact with/struck against	0.06 (2,4,5)				
	Powered vehicles (Base Services) Vehicle unavailable	0.30 (0,3,6)				
	Powered vehicles (Base Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Base Services) Vehicle fails to maintain position	0.03 (1,3,5)				
	Powered vehicles (Base Services) Contact with/struck against	0.06 (2,4,5)				
	TOTAL	14.76				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 2 — Consider creating a centralized office for administering powered equipment	*Powered vehicles (Pier Services)* Vehicle unavailable	0.30 (0,3,6)				
	Powered vehicles (Industrial Services) Vehicle unavailable	0.30 (0,3,6)				
	Powered vehicles (Base Services) Vehicle unavailable	0.30 (0,3,6)				
	TOTAL	0.9				
Recommendation 3 — Consider providing additional lighting in Building 7 and Building 3 to increase visibility	*Powered vehicles (Industrial Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Struck by/contact by	0.06 (2,4,5)				
	Powered vehicles (Industrial Services) Contact with/struck against	0.06 (2,4,5)				
	Lifting equipment (Industrial Services) Caught in/on/by/between	0.33 (1,4,6)				
	Powered vehicles (Base Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Base Services) Contact with/struck against	0.06 (2,4,5)				
	Powered vehicles (Base Services) Struck by/contact by	0.06 (2,4,5)				
	TOTAL	7.2				
Recommendation 4 — Consider implementing a USCG policy on periodic rests for crane operators (e.g., 15 minutes every 2 hours).	*Lifting equipment (Pier Services)* Incorrect load position/direction/speed	0.04 (2,3,5)				
	Lifting equipment (Base Services) Incorrect load position/direction/speed	Screened				
	TOTAL	0.04				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 5 — Consider modifying safety standards to allow the purchase of steel-toed shoes that have soft, nonslip soles	*Powered vehicles (Pier Services)* Struck by/contact by	0.33 (4,4,4)				
	Powered vehicles (Pier Services) Slip/trip/fall	0.06 (2,4,5)				
	Lifting equipment (Pier Services) Slip/trip/fall	0.06 (2,4,5)				
	Powered vehicles (Industrial Services) Struck by/contact by	0.06 (2,4,5)				
	Powered vehicles (Industrial Services) Slip/trip/fall	0.06 (2,4,5)				
	Powered vehicles (Base Services) Struck by/contact by	0.06 (2,4,5)				
	Powered vehicles (Base Services) Slip/trip/fall	0.06 (2,4,5)				
	Structures (Pier Services) Slip/trip/fall	0.06 (2,4,5)				
	Industrial systems/equipment (Industrial Services) Slip/trip/fall	0.03 (1,2,5)				
	Industrial systems/equipment (Base Services) Slip/trip/fall	0.33 (2,5,5)				
	TOTAL	1.11				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 6 —Consider providing warning lights at building exits and at pier entrances/exits to slow down powered equipment as it transits into/out of buildings/piers	*Powered vehicles (Pier Services)* Contact with/struck against	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Contact with/struck against	0.06 (2,4,5)				
	Powered vehicles (Base Services) Contact with/struck against	0.06 (2,4,5)				
	TOTAL	6.78				
Recommendation 7 —Consider installing four-way stop signs, which will require powered equipment to stop when exiting buildings	*Powered vehicles (Pier Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Struck by/contact by	0.06 (2,4,5)				
	Powered vehicles (Base Services) Struck by/contact by	0.06 (2,4,5)				
	TOTAL	6.78				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 8 — Consider implementing a policy requiring vehicles to give right-of-way to forklifts and powered equipment	*Powered vehicles (Pier Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Pier Services) Struck by/contact by	0.33 (4,4,4)				
	Powered vehicles (Industrial Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Struck by/contact by	0.06 (2,4,5)				
	Powered vehicles (Base Services) Struck by/contact by	0.06 (2,4,5)				
	TOTAL	7.11				
Recommendation 9 — Consider providing spill kits on the forklifts to enable immediate response to liquid spills near storm water drains	*Powered vehicles (Industrial Services)* Toxic/corrosive/reactive materials exposure	0.01 (2,3,4)				
	Drainage services (Base Services) Toxic/corrosive/reactive materials exposure	0.06 (1,4,5)				
	TOTAL	0.07				
Recommendation 10 — Consider streamlining the chain of command for processing requisitions for powered equipment spare parts to allow rapid replacement of spare parts	*Powered vehicles (Pier Services)* Vehicle unavailable	0.30 (0,3,6)				
	Powered vehicles (Industrial Services) Vehicle unavailable	0.30 (0,3,6)				
	Powered vehicles (Base Services) Vehicle unavailable	0.30 (0,3,6)				
	TOTAL	0.9				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 11 —Consider requiring periodic requalification training for forklift operators based on (1) the length of time since previous training and (2) operating time	*Powered vehicles (Pier Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Pier Services) Contact with/struck against	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Vehicle fails to maintain position	0.03 (1,3,5)				
	Powered vehicles (Industrial Services) Contact with/struck against	0.06 (2,4,5)				
	Powered vehicles (Base Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Base Services) Contact with/struck against	0.06 (2,4,5)				
	TOTAL	13.47				
Recommendation 12 —Consider requiring chains for operating powered equipment in icy weather	*Powered vehicles (Pier Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Pier Services) Contact with/struck against	3.33 (3,5,7)				
	Powered vehicles (Base Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Base Services) Contact with/struck against	0.06 (2,4,5)				
	TOTAL	10.05				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 13 — Both the ISC and tenant command (including vessels) should consider requiring unit all-hands training on forklift operations	*Powered vehicles (Pier Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Pier Services) Contact with/struck against	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Industrial Services) Vehicle fails to maintain position	0.03 (1,3,5)				
	Powered vehicles (Industrial Services) Contact with/struck against	0.06 (2,4,5)				
	Powered vehicles (Base Services) Incorrect position, direction, power/speed	3.33 (3,5,7)				
	Powered vehicles (Base Services) Contact with/struck against	0.06 (2,4,5)				
	TOTAL	13.47				
Recommendation 14 — Consider posting speed limit signs at additional locations on the piers	*Powered vehicles (Pier Services)* Struck by/contact by	0.33 (4,4,4)				
	Powered vehicles (Base Services) Struck by/contact by	0.06 (2,4,5)				
	TOTAL	0.39				
Recommendation 15 — Consider implementing a USCG policy on training riggers on load-lifting operations	*Lifting equipment (Pier Services)* Incorrect load position/direction/speed	0.04 (2,3,5)				
	Lifting equipment (Base Services) Incorrect load position/direction/speed	Screened				
	TOTAL	0.04				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 16 —Consider point-system penalties for motor vehicle violations, which would be applied to base-driving privileges	*Powered vehicles (Base Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	TOTAL	3.33				
Recommendation 17 —Consider adding seat belt violations to the point system for limiting base-driving privileges	*Powered vehicles (Base Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	TOTAL	3.33				
Recommendation 18 —Consider increasing the frequency of all-hands training on motor vehicle safety (ISC and tenant commands)	*Powered vehicles (Base Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	TOTAL	3.33				
Recommendation 19 —Consider more strictly enforcing motor vehicle moving violations per the ISC Standard Operating Procedure	*Powered vehicles (Base Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	TOTAL	3.33				
Recommendation 20 —Consider more strictly enforcing the requirement that ISC tenant commands follow the ISC Standard Operating Procedure and COMDINST when operating motor vehicles	*Powered vehicles (Base Services)* Incorrect position, direction, power/speed	3.33 (3,5,7)				
	TOTAL	3.33				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 21 —Consider defining a program of (1) regular visual inspections of piles supporting Pier 37, Pier 36, Building 3, and the apron for Piers 36/37 and (2) selective nondestructive examinations (e.g., ultrasonic tests) of wooden piles supporting Pier 36, Building 3, and the apron for Piers 36/37	*Structures (Pier Services)* Structural degradation	0.33 (4,4,4)				
	Structures (Base Services) Structural degradation	0.33 (4,4,4)				
	TOTAL	0.66				
Recommendation 22 —Consider modifying the guides that keep the floating dock in place to (1) help prevent damage to the piles and (2) reduce the potential for personnel injury during maintenance (being caught between the guide and piles)	*Structures (Pier Services)* Excessive dynamic structural loading	0.33 (4,4,4)				
	Structures (Pier Services) Caught in/on/by/between	0.06 (2,4,5)				
	TOTAL	0.39				
Recommendation 23 —Consider developing and implementing a method to regularly check structures for gross movement/ deflection using simple visual observations	*Structures (Pier Services)* Structural degradation	0.33 (4,4,4)				
	Structures (Base Services) Structural degradation	0.33 (4,4,4)				
	TOTAL	0.66				
Recommendation 24 —Consider implementing a formal system for keeping personnel (especially new personnel) who are responsible for movement/placement of heavy loads aware of (1) current load limits on the piers and in Building 3 and (2) the types of loads that may exceed those limits	*Structures (Pier Services)* Excessive static structural loading	0.63 (4,5,5)				
	Structures (Base Services) Excessive static structural loading	0.0033 (2,2,1)				
	TOTAL	0.63				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 25 —Consider ensuring that existing secondary emergency exits for Building 1 are (1) readily identifiable from within the building and (2) provide unobstructed egress from the building 24 hours a day	*Structures (Base Services)* Fire/explosion	0.09 (3,4,5)				
	TOTAL	0.09				
Recommendation 26 —Consider including in routine safety meetings information about site asbestos and lead exposure risks (and associated protection precautions)	*Structures (Base Services)* Toxic/corrosive/reactive materials exposure	0.003 (2,0,0)				
	TOTAL	0.003				
Recommendation 27 —Consider taking additional steps to protect the side of Building 1 from vehicles that may lose control on the road outside of the site	*Structures (Base Services)* Excessive dynamic structural loading	0.63 (4,5,5)				
	TOTAL	0.63				
Recommendation 28 —Consider providing a nonskid surface along the emergency escape path on the roof of Building 1	*Structures (Base Services)* Slip/trip/fall	0.30 (1,2,6)				
	TOTAL	0.3				
Recommendation 29 —Consider providing fire protection insulation for the exposed structural steel members in Building 3	*Structures (Base Services)* Fire/explosion	0.09 (3,4,5)				
	TOTAL	0.09				
Recommendation 30 —Consider repairing the uneven walkway outside of Building 1	*Structures (Base Services)* Slip/trip/fall	0.30 (1,2,6)				
	TOTAL	0.3				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 31 —Consider upgrading Building 1 to make emergency exit paths in all areas of the building consistent with current code requirements	*Structures (Base Services)* Fire/explosion	0.09 (3,4,5)				
	TOTAL	0.09				
Recommendation 32 —Consider raising the railing in the fifth floor stairwell of Building 1	*Structures (Base Services)* Slip/trip/fall	0.30 (1,2,6)				
	TOTAL	0.3				
Recommendation 33 —Consider fastening the shelves on the steel frames of storage bins in Building 3 (and other areas as applicable) to reduce the likelihood of equipment falling from the shelves	*Warehousing services (Industrial Services)* Slip/trip/fall	0.03 (0,3,5)				
	TOTAL	0.03				
Recommendation 34 —Consider implementing a system to ensure that structures are appropriately inspected after an earthquake in the Seattle area	*Structures (Base Services)* Excessive dynamic structural loading	0.63 (4,5,5)				
	Structures (Pier Services) Excessive dynamic structural loading	0.333 (4,4,4)				
	TOTAL	0.96				
Recommendation 35 —Consider defining an appropriate inspection/monitoring program for the piles supporting the foundations of Building 1, Building 2, and Building 7	*Structures (Base Services)* Structural degradation	0.33 (4,4,4)				
	TOTAL	0.33				
Recommendation 36 —Consider upgrading the fire alarm system in Building 1	*Structures (Base Services)* Fire/explosion	0.09 (3,4,5)				
	TOTAL	0.09				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 37 —Consider installing a sprinkler system in Building 1	*Structures (Base Services)* Fire/explosion	0.09 (3,4,5)				
	TOTAL	0.09				
Recommendation 38 —Consider implementing routine tests to ensure the dependability of safety switches on motor-driven doors	*Structures (Base Services)* Struck by/contact by	Screened				
	TOTAL	—				
Recommendation 39 —Consider implementing a formal test program for the fire protection system installed under Pier 36, Building 3, and the apron for Piers 36/37	*Structures (Pier Services)* Fire/explosion	0.0033 (2,2,2)				
	Structures (Base Services) Fire/explosion	0.09 (3,4,5)				
	TOTAL	0.09				
Recommendation 40 —Consider installing shear walls in Building 1 and Building 7 to help minimize the vulnerability of those buildings to structural damage in the event of a significant earthquake	*Structures (Base Services)* Excessive dynamic structural loading	0.63 (4,5,5)				
	TOTAL	0.63				
Recommendation 41 —Consider replacing the transition piece between the boathouse and the floating dock with a curved plate (instead of the current flat plate)	*Structures (Pier Services)* Slip/trip/fall	0.06 (2,4,5)				
	TOTAL	0.06				
Recommendation 42 —Consider providing a filtration system for the drinking water piping in Building 1	*Potable water services (Base Services)* Potable water quality problem	0.006 (2,3,3)				
	TOTAL	0.006				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 43 —Consider modifying the compressed air system, air supply lines, or the firewater sprinkler system in Building 3 to reduce the number of times that water must be removed from the sprinkler piping as a result of leaks in the air supply lines	*Compressed air services (Base Services)* Inadequate/no compressed air	0.3 (0,0,6)				
	TOTAL	0.3				
Recommendation 44 —Consider replacing the piping and fixtures in the water supply lines for Building 1 to eliminate lead exposure risks in the building's potable water supply	*Potable water services (Base Services)* Potable water quality problem	0.006 (2,3,3)				
	TOTAL	0.006				
Recommendation 45 —Consider providing a backflow preventer to keep particulates in the firewater system from entering the potable water system in the event of a loss of potable water supply pressure	*Potable water services (Base Services)* Potable water quality problem	0.006 (2,3,3)				
	TOTAL	0.006				
Recommendation 46 —Consider providing sound barriers around air compressors to eliminate the need for hearing protection in areas where compressors are operating	*Compressed air services (Base Services)* High noise exposure	Screened				
	TOTAL	—				
Recommendation 47 —Consider whether hearing protection should be worn at all times in areas where loud, periodically operating equipment (e.g., generators, compressors) could start at any time	*Compressed air services (Base Services)* High noise exposure	Screened				
	Electrical power (Base Services) High noise exposure	Screened				
	TOTAL	—				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 48 —Consider immunizing all maintenance personnel against hepatitis due to possible contact with the sewage system	*Sewage services (Pier Services)* Biological hazards exposure	0.03 (1,4,4)				
	TOTAL	0.03				
Recommendation 49 —Consider improving craft training in specific technologies (especially new technologies such as PC controllers)	*Industrial systems/equipment (Industrial Services)* Poor quality products, service, or operations	0.36 (4,4,5)				
	Industrial systems/equipment (Base Services) Poor quality products, service, or operations	0.60 (2,5,6)				
	TOTAL	0.96				
Recommendation 50 —Consider defining an appropriate preventive maintenance program for the high voltage transformers/switchgear at the site	*Electrical power (Base Services)* Inadequate/no electrical power service	0.60 (4,5,0)				
	Electrical power (Base Services) Incorrect electrical power frequency, voltage, phase	0.60 (1,5,6)				
	TOTAL	1.2				
Recommendation 51 —Consider transferring operation of high voltage transformers/switchgear at the site to the local utility	*Electrical power (Base Services)* Inadequate/no electrical power service	0.60 (4,5,0)				
	Electrical power (Base Services) Incorrect electrical power frequency, voltage, phase	0.60 (1,5,6)				
	TOTAL	1.2				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 52 —Consider implementing a formal system defining how base personnel will monitor contractor work and equipment/materials provided by contractors to identify/correct potential quality problems	*Industrial systems/equipment (Base Services)* Poor quality products, service, or operations	0.60 (2,5,6)				
	TOTAL	0.6				
Recommendation 53 —Consider periodically inspecting or replacing the hose used to refuel vessels at the floating dock	*Fueling services (Base Services)* Toxic/corrosive/reactive materials exposure	0.06 (2,4,5)				
	Fueling services (Base Services) Fire/explosion	Screened				
	TOTAL	0.06				
Recommendation 54 —Consider providing secondary containment (e.g., a curbed area) for the fuel unloading area near the underground fuel storage tank to help prevent fuel spills from entering Puget Sound	*Fueling services (Base Services)* Toxic/corrosive/reactive materials exposure	0.06 (2,4,5)				
	TOTAL	0.06				
Recommendation 55 —Consider implementing an ISC instruction requiring vessel Commanding Officers to be aware of and implement safeguards needed when handling/transferring ammunition on/off vessels	*Small caliber weapons and other weapons (Pier Services)* Strain	0.03 (1,3,5)				
	TOTAL	0.03				

Table B.1 Worksheet for Establishing the Risk Reduction of Coarse Hazard Analysis Recommendations for ISC Seattle (cont'd)

Recommendation	Associated Deviation(s)	Initial RIN (Frequencies)	Revised RIN (Frequencies)	Change in RIN	Certainty/ Notes	$/Year Risk Reduction (Lower/Upper)
Recommendation 56 —Consider replacing the current fueling system for the floating dock with a system positioned on the apron for Piers 36/37 and a boom that extends to the fueling positions	*Fueling services (Base Services)* Toxic/corrosive/reactive materials exposure	0.06 (2,4,5)				
	Fueling services (Base Services) Fire/explosion	Screened				
	TOTAL	0.06				
Recommendation 57 —Consider training on the physical hazards associated with lifting/transferring small arms ammunition	*Small caliber weapons and other weapons (Pier Services)* Strain	0.03 (1,3,5)				
	Small caliber weapons and other weapons (Base Services) Strain	0.06 (1,4,5)				
	TOTAL	0.09				
Recommendation 58 —Consider providing contracted security personnel (armed) for roving security watchstanding functions	*Security services (Base Services)* No/inadequate security	0.03 (1,3,5)				
	TOTAL	0.03				